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APPENDIX A
ENVIRONMENTAL SCOPING SUMMARY REPORT

Docket No. 70-7004

ENVIRONMENTAL IMPACT STATEMENT SCOPING PROCESS

ENVIRONMENTAL SCOPING SUMMARY REPORT

**Proposed USEC Inc.
American Centrifuge Plant
Piketon, Ohio**

April 2005



**U.S. Nuclear Regulatory Commission
Rockville, MD**

1. INTRODUCTION

On August 23, 2004, USEC Inc. (USEC) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) for a license to construct, operate, and decommission the American Centrifuge Plant (ACP), a gas centrifuge uranium enrichment facility located on the U.S. Department of Energy (DOE) reservation in Piketon, Ohio. The ACP, if licensed, would enrich uranium for use in commercial nuclear fuel for power reactors. Feed material would be comprised of non-enriched uranium hexafluoride (UF₆). USEC proposes to use centrifuge technology to enrich the isotope uranium-235 in the UF₆ up to 10 percent. The initial license application is for a 3.5 million separative work unit (SWU)¹ facility. Because USEC indicated the potential for future expansion to 7.0 million SWU per year, the environmental review will look at the impacts from a 7.0 million SWU per year facility.

In accordance with NRC regulations in 10 CFR Part 51, and the National Environmental Policy Act (NEPA), the NRC is preparing an Environmental Impact Statement (EIS) for the proposed facility as part of its decision-making process. The proposed action is the issuance of an NRC license for USEC to possess and use special nuclear material, source material, and byproduct material at the proposed ACP. The activities to be conducted under the license would include the construction, operation and decommissioning of the proposed ACP. The EIS will examine the potential environmental impacts associated with the proposed ACP in parallel with the review of the license application. The EIS will be prepared by NRC staff with technical assistance from ICF Consulting Inc. and Trinity Engineering Associates. The NRC has not identified any cooperating agencies for the preparation of this EIS. In addition to the EIS, the NRC will prepare a Safety Evaluation Report (SER) which will document the staff's review of safety and security issues.

The NRC plans to operate on a 30-month licensing schedule with 19 months allocated for the environmental review. The current schedule for publication of the draft EIS is in August 2005, with a public meeting scheduled in September 2005 after publication of the draft EIS. The final EIS is tentatively scheduled for publication in March, 2006.

As part of the NRC's environmental review, and to comply with 10 CFR 51.26 and 51.27, scoping was initiated on October 15, 2004, with the publication in the *Federal Register* of a Notice of Intent to prepare an EIS and to conduct a scoping process (69 *Fed. Reg.* 61268). Scoping is an early and open part of the NEPA process designed to help determine the range of actions, alternatives, and potential impacts to be considered in the EIS, and identify significant issues related to the proposed action. The NRC solicits input from the public and other agencies in order to focus on issues of genuine concern.

On January 18, 2005, the NRC staff held a public scoping meeting in Piketon, Ohio, to receive both oral and written comments from interested parties. The public scoping meeting began with NRC staff providing a description of the NRC's role, responsibilities, and mission. A brief overview of the safety review process was followed by a description of the environmental review process and a discussion of how the public can effectively participate. The majority of the meeting was reserved for attendees to ask questions and make comments on the scope of the environmental review. The NRC postponed the originally scheduled public scoping meeting in Piketon, Ohio from November 15, 2004 until January 18, 2005 after removal of public

¹ SWU relates to a measure of the work used to enrich uranium.

documents from the NRC public reading room and website for several weeks in November 2004 due to security concerns. Due to this delay, the public scoping comment period was extended from December 6, 2004 until February 1, 2005.

As part of the environmental review, NRC has begun a consultation process with the Ohio State Historic Preservation Officer (SHPO) as required by Section 106 of the National Historic Preservation Act. In accordance with 36 CFR 800.3(f), NRC will consult with Native American Tribal members identified by the SHPO and will consult with representatives of the Pike County Commission. Other consultations will include the Fish and Wildlife Service as required by Section 7 of the Endangered Species Act.

This report has been prepared to summarize the determinations and conclusions reached in the scoping process as required in 10 CFR 51.29(b). After publication of the draft EIS, the public will be invited to submit additional comments. Availability of the draft EIS, the dates of the public comment period, and information about a public meeting to be held to discuss the draft EIS will be announced in the *Federal Register*, on NRC's website (<http://www.nrc.gov/materials/fuel-cycle-fac/usecfacility.html>), and in the local news media when the draft EIS is distributed. After evaluating comments on the draft EIS, the NRC staff will issue a final EIS that will serve as the basis for the NRC's consideration of environmental impacts in its decision on the proposed ACP.

This report is organized into four main sections. Section 1 provides an introduction and background information on the environmental review process. Section 2 summarizes the comments and concerns expressed by government officials, agencies, and the public. Section 3 identifies the issues that the draft EIS will address and Section 4 describes those issues that are not within the scope of the draft EIS. Where appropriate, Section 4 also identifies other places in the decision-making process where issues that are outside the scope of the draft EIS may be considered.

2. ISSUES RAISED DURING THE SCOPING PROCESS

2.1 OVERVIEW

Approximately 80 individuals not affiliated with the NRC attended the January 18, 2005 public scoping meeting concerning the USEC license application for the ACP. During the meeting, five individuals asked specific questions about the scoping process. Sixteen individuals offered specific oral comments related to the proposed ACP. In addition, 24 written comments, including 1 duplicate, were received from various individuals during the public scoping period, which ended on February 1, 2005. The scoping meeting transcript (ML050590321) and the 24 written comments received by the NRC are available on the NRC website, electronic reading room, at <http://www.nrc.gov/reading-rm/adams/web-based.html>.

The active participation of the public in the scoping process is an important component in determining the major issues that the NRC should address in the draft EIS. Individuals providing oral and written comments addressed several subject areas related to the proposed USEC facility and the draft EIS development. In addition to private citizens, the various commenters included:

- A representative of the Governor of Ohio.
- A local official from the Village of Piketon.
- Pike and Scioto County Commissioners.
- Representatives of the Pike County Chamber of Commerce and the Chillicothe/Ross County Chamber of Commerce.
- Representatives of State of Ohio agencies or departments.
- Representatives of local businesses.
- Representatives of other organizations including:
 - Public Citizen
 - Portsmouth/Piketon Residents for Environmental Safety
 - National Nuclear Workers for Justice
 - Paper, Allied-Industrial, Chemical and Energy Workers International Union
 - Sierra Club, Central Ohio Group and Appalachian Ohio Section
 - Southern Ohio Diversification Initiative

The following general topics categorize the comments received during the public scoping period:

- NEPA and public participation.
- Need for the proposed facility.
- Land use.
- Alternatives.
- Ecology, air quality, soil and water resources.
- Socioeconomics.
- Transportation.
- Waste management.
- Historic and cultural resources.
- Cumulative impacts.
- Decommissioning.
- Safety and risk.
- Nuclear nonproliferation and security.
- Terrorism.
- Credibility.

In addition to raising important issues about the potential environmental impacts of the proposed facility, some commenters offered opinions and concerns that typically would not be included in the subject matter of an EIS - these include general opinions about nuclear proliferation and the use of nuclear energy. Comments of this type do not fall within the scope of environmental issues to be analyzed. Other statements may be relevant to the proposed action, but they have no direct bearing on the evaluation of alternatives or on the decision-making process involved in the proposed action. For instance, general statements of support for or opposition to the proposed action fall into this category. Again, comments of this type have been noted but are not used in defining the scope and content of the draft EIS.

Section 2.2 summarizes the comments received during the public scoping period. Most of the issues raised have a direct bearing on the NRC's analysis of potential environmental impacts.

2.2 SUMMARY OF ISSUES RAISED

As noted above, a number of commenters expressed support for the facility. Several individuals, on the other hand, raised concerns regarding the construction and operation of the proposed ACP. The following summary groups the comments received during the scoping period by technical area and issue.

2.2.1 NEPA and public participation

Several commenters expressed general support for the ACP stating that the facility would be beneficial to the economy. One commenter questioned the role of members of the public not located in the Piketon area and their possible impact on the decision-making process. The commenter stated that the focus of public participation should be on those members of the public most directly affected by the proposed facility. However, another commenter disagreed, stating that because materials, including wastes, would be shipped from the facility to various points around the country, everyone who is potentially affected by the facility should be included in the public participation process.

A number of commenters requested an extension of the time period for submitting comments on the scope of the draft EIS. These commenters cited several reasons for the extension request, but the reason cited most often was the lack of availability of documents on NRC's website because of security concerns. Two commenters noted that the public was not made aware of a public meeting on November 9, 2004, where USEC's record of accidents and contamination releases was discussed. Several commenters also noted that some of the information on NRC's website is not accessible, including information on reportable events such as releases from the plant. One commenter also noted that answers to questions that she submitted to the NRC on December 2, 2004 had not yet been answered.

Several commenters raised concerns regarding the availability of information contained in the license application and the Environmental Report. One commenter stated that some of the information related to the application has been classified as confidential for security purposes and therefore the public does not have access to it. Another commenter stated that the public should have access to all the information it may reasonably be expected to have known about. This commenter requested that NRC make all redactions in the ER available to the public, including Appendices B, D, and E. If not, the commenter requested an explanation as to why the information was redacted. Another commenter stated that restricting the public from information for reasons other than security protection constitutes an infringement on the democratic involvement of the people in the actions of its government. One commenter noted that an EIS had been completed for the Piketon site in the past, and that this document should be reviewed to determine if any information contained in that report is relevant to the proposed ACP.

Other comments included one person who indicated that she is entitled to a full copy of the license application. Another commenter stated that scoping should include perspective of those outside of the local community. A commenter also thought that it is important that impacts and alternatives must be assessed before an action is taken, not to justify a decision already made. Another commenter stated that it is expected that NRC will provide regulatory guidelines that will allow USEC to operate a plant efficiently with protection for both workers and the community.

A commenter specifically stated that the draft EIS should carry out a comprehensive evaluation that honestly takes into account the long-term environmental impacts of the proposed project. This commenter noted that this type of evaluation is especially relevant to facilities involved in the production of fuel for nuclear reactors because of the length of time the waste material is dangerous and the need for containment and monitoring for the duration of that time. Finally, two commenters requested waivers of fees for documents related to the licensing action.

2.2.2 Need for the proposed facility

A number of commenters raised concerns about the need for a uranium enrichment facility. One commenter argued that the public must agree on the need for the facility. Several commenters stated that the draft EIS must analyze the need for the proposed facility given the existing enriched uranium stockpiles that could meet the needs for nuclear energy for several years. A commenter also stated that the draft EIS should consider that the proposed LES facility in New Mexico could actually start operations first, lessening the need for the ACP. Commenters indicated that the potential for an international moratorium on uranium enrichment exists, and the ramifications of this action should be accounted for in the analysis. Other commenters indicated that recent budget cuts and uncertainty in energy policy lessen the need for additional enriched uranium production. Specifically, one commenter stated that the draft EIS should evaluate the potential for a pause in production of nuclear fuel, which would allow the NRC and other agencies to focus resources in other areas such as cleaning up existing contamination, developing safe and permanent waste disposal options, lowering transportation risks, better documenting releases and events, and encouraging development of clean, safe, well-paying jobs.

Another commenter stated, however, that there will be an increase in demand for electricity in the future and that nuclear power will be critical to ensuring this supply and promoting energy independence. The commenter noted that the ACP would play a key role in providing that energy.

Other commenters stated that the draft EIS should evaluate the development of other less expensive, renewable energy resources with less significant environmental impacts. Commenters also suggested that material from disassembled nuclear weapons could be used as an alternate source for uranium enrichment.

A commenter stated that the draft EIS should address whether the operation of the ACP will have a negative impact on the “Megatons to Megawatts” program, in which highly enriched uranium from dismantled Russian nuclear weapons is down-blended and used as fuel in U.S. nuclear power plants. Another commenter requested an explanation as to why USEC requires a license for 10 percent assay when the license application states that USEC believes its customers only require 5 percent assay UF_6 .

2.2.3 Land use

A commenter expressed concern that the increased safety and security restrictions accompanying the proposed ACP would limit alternative use of the site. In addition, a commenter stated that the proposed ACP would eliminate the opportunities for cleanup and reuse of certain facilities on DOE’s Portsmouth Reservation, beyond the scope of the USEC license. Another commenter asked whether the existing contamination cleanup at the site is far

enough along to ensure protection of site workers. The commenter wondered whether existing contamination could be cleaned up prior to the start of operations at the ACP. Another commenter was concerned that the ACP would restrict the possibility of public use of undeveloped parts of the site. Another commenter asked how the proposed ACP will affect farmland.

2.2.4 Alternatives

Several commenters noted that the draft EIS needs to address the full range of “reasonable alternatives.” Commenters stated that alternative uses for the site, including private leasing and other governmental uses, must be developed and considered in the draft EIS. A commenter also stated that the reasonable alternatives must encompass not only the centrifuge buildings, but a “multiplicity of other uses” for other parts of the site. A commenter suggested instituting accelerated site cleanup as an alternative to allow the facility to be used for nonnuclear industry development. Another commenter suggested specifically that the draft EIS should analyze the Southern Ohio Diversification Initiative suggestion to locate a truck manufacturing company in one of the buildings. A commenter also suggested that the X-326 building could be entombed as a National Monument. A commenter stated that the draft EIS should consider expanding the “Megatons to Megawatts” program as an alternative to licensing the ACP. This commenter also stated that a reasonable alternative would be to consider reviving the Atomic Vapor Laser Isotope Separation process because the centrifuge technology concentrates uranium-234. A commenter suggested moving the environmental cleanup research program located at Oak Ridge National Laboratory to Piketon since the site will be the subject of ongoing environmental cleanup.

Another commenter stated that the cultural value of the Piketon site and the potential adverse impacts to these resources that have not been studied indicates two alternatives that should be considered including (1) moving the ACP to the Paducah site, and (2) opening part of the Piketon site as a cultural resource park with restoration of the earthworks.

Commenters also suggested that the draft EIS should analyze scenarios under which the ACP fails or the project is cancelled. A number of commenters stated that if the plant proceeds and becomes operational, this will preclude the site from any future use because of security restrictions and contamination, and will change or eliminate possibilities for reuse of certain facilities. A commenter stated that the impacts of the no-action alternative should be considered in terms of the site, not USEC’s commitments to DOE to provide enriched uranium for nuclear fuel.

Another commenter stated that the draft EIS should focus on evaluating the impacts of a 3.5 million SWU per year plant and that any evaluation of impacts for a 7.0 million SWU per year plant should be done separately under a different licensing action.

2.2.5 Ecology, air quality, soil and water resources

Ecology: Several commenters stated that the wildlife of the region, including deer and fish, has been shown to be contaminated with radioactivity and expressed concern about the migration of wildlife in and out of the plant boundaries. One commenter suggested that procedures be put into place to ensure that wildlife that travel outside the plant boundaries will not carry additional contamination into the greater community. Another commenter was

concerned with the protection of birds and other animal species from future contamination. One commenter expressed general concern over the impact of air and water emissions on wildlife. Another commenter expressed the specific concern that chemical and radioactive leakage from DUF₆ cylinders might adversely affect fish downstream in the Scioto and Ohio rivers.

Air Quality and Soil: A number of commenters were concerned about the release of radioactive materials into air and soil. One commenter asked for a list of the kinds of air emissions likely to be released from the plant and another thought that emissions should be monitored by an independent agency.

Water Resources: A number of commenters were concerned with the plant's water usage, specifically the source of water and estimated volumes that will be used. Many commenters were concerned that chemical and radioactive leakage from plant operations and waste, including DUF₆ cylinders, might adversely affect the groundwater and surface water quality of the region. Several commenters asked for information about the kinds of contaminants likely to be released into the water and about current and future stream protection measures. Another stated that stream sediments have been found to have radioactivity five times the natural levels as well as increased levels of arsenic, cadmium, chromium, and mercury. The same commenter stated that Little Beaver Creek has a total uranium level nearly twice the level at which corrective action would be required at civilian nuclear plants. A commenter asked for the location of discharge points, any associated discharge standards (especially for radioactive contaminants), and the consequences for exceeding release limits. Another commenter requested information about radioactive concentration limits for discharges, and asked who was responsible for monitoring water discharges. One commenter recommended that an independent agency be in charge. A commenter recommended that storm-water analysis include scenarios of extreme climate conditions (i.e., flooding, tornados, earthquakes) that may be expected to occur over the projected lifetime of the plant. Another commenter stated that as an alternative to releases in streams and rivers, USEC should consider a "closed lid" system for managing effluents from plant operations.

2.2.6 Socioeconomics

A number of commenters expressed their support for the approximately 500 permanent high-paying, high-tech jobs and the hundreds of construction jobs that USEC expects to bring to the region. One commenter was in support of USEC's "long-term commitment to provide jobs to this region" and thought that "the plant represents an investment in the future of southern Ohio." Another expressed the desire to have future job opportunities in the area for his children and grandchildren. Many commenters stated their belief that having a new \$1.5 billion plant will help boost the local economy. One commenter stated that the presence of a uranium enrichment facility has not depressed land values or resulted in a decrease in population in Pike County, like some have claimed. The commenter pointed to the existence of expensive property values and a 12.5 percent population increase in the last decade.

One commenter stated that the proposed plant would be bad for the local economy. Another said that the proposed ACP will inhibit the creation of thousands of jobs because a similar investment of \$1.5 billion by any other company should generate 7,000 or 8,000 jobs instead of the 500 expected for the proposed facility.

2.2.7 Transportation

A commenter expressed satisfaction with current transportation regulations and specifications for the materials, construction, and procedures for containerizing/packaging contaminated material. The commenter stated that it would be “virtually impossible in a derailment scenario for contaminated material to get out.” Another commenter expressed no confidence that USEC will actually meet the U.S. Department of Transportation’s safety requirements when shipping radioactive materials. Several commenters had concerns about the safety of road conditions along the routes across Ohio and to other States like Tennessee, especially in regard to the transport of radioactive waste. They asked for information regarding evaluations of the roads for trucks and rail systems for trains and the standard procedures for transporting materials to and from the facility.

2.2.8 Waste management

General Waste Management: Several commenters stated that waste management must be analyzed in detail in the draft EIS. A commenter expressed concern that the Piketon site is already a nuclear waste disposal site and that the ACP will only add to the problem. Another commenter stated that DOE has already been shipping wastes to Piketon from other sites including Fernald, Oak Ridge, and Paducah and that the transfers would not happen if the ACP were not licensed. The commenter stated that there is a need to identify all the wastes that have been shipped to the site and what will ultimately happen to these wastes. Another commenter stated that all “newly generated” waste streams associated with the ACP should be fully characterized in the draft EIS.

Depleted UF₆ Storage and Disposal: An issue raised by numerous commenters concerned the plans for management of the DUF₆ tails currently stored onsite from past operations, similar wastes from other sites, and those tails expected to be generated as part of the ACP operations. These commenters stated that the draft EIS must address how much waste will be generated by the ACP, where the tails will ultimately go, and whether they could potentially be left onsite for long-term storage. Several commenters indicated that long-term storage of DUF₆ onsite at Piketon is not a reasonable waste management alternative. Two commenters noted that the possible conversion of DUF₆ by the DOE could take years (possibly up to 25 years), with the material being stored onsite in the meantime. A commenter stated that there are currently thousands of these waste cylinders at Piketon and they present a higher risk of radiation contamination to the environment. Another commenter noted that the ACP will only add to the amount of existing DUF₆ that needs to be converted or disposed.

Commenters also stated that, prior to licensing, a contract should be in place describing how and where DUF₆ tails will be disposed. A commenter recommended that the draft EIS describe in detail how much tails disposal will cost and consider the cost of disposal on USEC’s ability to pay for the ACP (including decommissioning). Another commenter asked what limitations would be placed on the onsite storage of DUF₆ and whether any fines for noncompliance would be sufficient to motivate USEC to remove the wastes from the site for disposal.

2.2.9 Historic and cultural resources

Two commenters stated support for NRC to conduct a separate cultural resources assessment under Sections 106 and 110 of the National Historical Preservation Act (NHPA) at the Piketon site. These commenters indicated that DOE, which owns the site, has failed to conduct such

reviews previously. One commenter indicated that DOE has never attempted to identify properties that qualify for historic preservation on or near its land in Piketon.

A commenter stated that NRC must consider that in failing to conduct its own Section 106 review properly, DOE may have undermined the legal basis of its agreement with USEC to turn over its facilities for USEC's use.

One commenter stated that omissions of known archaeological sites in the DOE "Risk-Based End-State" report has allowed DOE to avoid its obligation of conducting a thorough cultural resource impact assessment of the site.

These same commenters indicated that the Piketon site has tremendous historical and prehistorical value that has never been studied. One commenter indicated that Pike County has two prehistoric sites (the Piketon Works and the Scioto Township Works), one on DOE's property and the other extending onto it. The commenter noted a third site (the Barnes Home) borders the proposed plant and once included land underneath the existing centrifuge plant. The commenter stated that the Barnes Home is currently under consideration for listing on the National Register of Historic Places, which qualifies it for full protection.

One commenter stated that the Piketon Works (National Register site 74001599) is located in the area where DOE uses earthen embankments to shield its water wells, which provide water to the site. The commenter indicated that pumping from these wells would resume with the operation of the ACP, but the possible effects of the pumping on the Piketon Works have not been studied. This same commenter stated that there has not been a recent survey of the Scioto Township Works (National Register site 74001600).

A commenter stated that DOE should make public a report that was used by USEC to support its contention that no important cultural resources survive on the site, so that the public can evaluate its contents.

One commenter argued that claims by DOE, USEC, and NRC that responsibility for adverse impacts extends only as far as the footprint of the proposed centrifuge plant is incorrect. This commenter stated that DOE and NRC, as Federal agencies, have the following responsibilities at the Piketon site:

- To assess the broad range of potential impacts of major Federal actions on cultural resources as part of the environmental review under NEPA;
- To assess and mitigate adverse impacts of major federal actions on sites that qualify for the National Register of Historic Places under Section 106 of the NHPA; and
- To protect and steward any historic or prehistoric resources on federal land under Section 110 of the NHPA.

The commenter went on to state that NRC must greatly expand the scope of its cultural resource impact analysis as part of the draft EIS and must conduct its own Section 106 review in compliance with NHPA. The commenter indicated that a review of the environmental impacts under NEPA is not a substitute for a Section 106 review unless the agency follows the

requirements of 36 CFR 800.8(c) regarding notifications, identification of historic properties and effects, consultation, and resolution of adverse comments. The commenter requested that NRC include in its review all kinds of effects on all kinds of properties, not simply direct effects on historic buildings or specific archaeological sites. The commenter noted that it may also be important for NRC to consider the possible need to address impacts on Native American graves and cultural items under the Native American Graves Protection and Repatriation Act; archaeological, historic, and scientific resources under the Archaeological and Historic Preservation Act; and cultural resources under NEPA.

2.2.10 Cumulative impacts

A commenter expressed concern over the cumulative effect and long-term public health impacts of building another uranium enrichment facility on the site of a retired one and stated that the draft EIS should consider this issue with increased scrutiny. Another commenter asked if the impact analysis considers that the site has existing contamination and that workers and community members have already had exposure.

2.2.11 Decommissioning

Several commenters expressed concern over USEC's financial standing and whether or not there was a funding plan for the plant's decontamination and decommissioning. There was concern that if USEC goes bankrupt, by default, DOE and taxpayer money would be utilized. Several commenters pointed out the fact that in 2004, DOE spent almost \$300 million in taxpayer money for cleanup and that the same is projected for 2005. The commenters recommend that NRC require USEC to create a performance bond, escrow account, or similar fund sufficient to cover the facility's cleanup prior to issuing a license. One commenter suggested that Pike County should possibly play a role in paying for the cleanup of the facility. Others recommended that cleanup costs should be paid by USEC up-front. Commenters also recommended that a study be done to assess total cleanup, waste storage, and decommissioning costs. One commenter asked about the existence of monitoring plans for radioactive landfills when the plant decommissions. The commenter recommended some kind of written agreement in advance to ensure that the DOE reservation does not become a waste dump.

Another commenter requested a detailed account of how Paducah decontamination and decommissioning operations would impact USEC's ability to pay for the development and operation of the ACP.

2.2.12 Safety and risk

Plant Safety: A number of commenters expressed confidence in the safety of the ACP, citing USEC's skilled, highly trained employees, strong employee safety programs and past safety record, and formalized programs to mitigate potential impacts in the event of emergencies. One commenter also noted that the likelihood of an accident that could affect the public is extremely low. Another commenter expressed confidence that USEC will continue to coordinate with the Ohio Environmental Protection Agency and the NRC, and will continue to utilize the most sophisticated tools available to assure the safety of its workers and the community. Another commenter requested information on noncritical, nonexplosive, and

accidental events that are apparently not contained in USEC's Environmental Report. The commenter indicated that information on the source of the contamination and cleanup actions for these releases should be made available and reviewed. The commenter also asked for an explanation of an apparent increase in worker exposure to UF_6 over time as seen from the Contaminated Feed Cleanup Project Dose Trend described in the Environmental Report.

One commenter noted that safety violations in earlier years were due in part to an incomplete understanding of the technology, putting workers at unnecessary risk. As a result, the community has taken a stronger interest in the safe operation of the plant. The commenter noted that it is believed that centrifuge technology is a "much safer and more efficient technology." Several commenters highlighted the great improvement in plant safety and efforts by both union and management working together as a team to ensure that workers and the public are protected. One person commented that "this plant is one of the safest in the country."

One commenter requested further information about the extent of personnel training to validate USEC's statement that "continuing education of employees and a closer monitoring by management can be used to help alleviate incidents." The commenter also asked about the procedure for a public alert after accidental releases. Another commenter recommended that NRC consider the effects of fire and ruptures in process piping in its safety analysis. A commenter also requested that the draft EIS investigate the claim by USEC that no regulated substances will be stored on the site in excess of threshold levels.

One commenter suggested that USEC's training programs should be reviewed because they are inadequate to the point where the plant would be unable to operate safely. The commenter referred to a management culture that "drags its heels to cover up mistakes."

Worker Health and Safety: Several commenters expressed concern over the general health of employees on the site. One commenter asked about the extent of worker monitoring programs and if monitoring will be done by an independent entity. Another commenter stated that "health issues and premature deaths are not being considered." Another questioned how occupational health and safety will be guaranteed and how it will be different from what was previously done during operation of the gaseous diffusion plant. The commenter expressed concern that USEC needs to be forthcoming and honest about the chemicals and substances the workers will be exposed to. One commenter suggested that NRC take into account a 1985 General Accounting Office report that the Portsmouth Gaseous Diffusion Plant workers had the highest exposure of any other gaseous diffusion plant. One commenter wanted assurance from NRC that USEC will always use the latest technology to ensure best possible safety practices to protect workers and the community.

A commenter also questioned the role of the Ohio Army National Guard workers at the site. The commenter asked for information on how many of these workers are at the site, where they are located, and what their role is, if any, in relation to the operation of the ACP.

2.2.13 Nuclear nonproliferation and security

Several commenters stated that operation of the ACP could have nonproliferation impacts. One of these commenters noted that the implications of the proposed ACP are international in scope. Another commenter indicated that the Carnegie report, "A Strategy for Nuclear

Security” states that production of even lower levels of enriched uranium than proposed at ACP could have a destabilizing effect on nuclear treaties and initiate a stepped-up arms race. Similarly, two commenters stated that initiatives such as operation of new uranium enrichment facilities might actually risk rather than enhance our national security by encouraging other countries’ nuclear weapons initiatives.

In a separate but related comment, one person indicated that the draft EIS should model the effect of security breaches by USEC.

2.2.14 Terrorism

Two commenters expressed concern that the ACP would present a significant risk as a terrorist target, leading to increased terror alerts. Several commenters recommended studies to consider scenarios involving terrorist attacks and to assess security and terrorist risks. A commenter requested information about measures that will be taken to increase security and keep unauthorized people away from the plant.

2.2.15 Credibility

Several commenters indicated that USEC has a good record as a corporate citizen and a good safety record, and people trust that the licensing process is fair and open. These commenters stated that they believe the ACP will be operated in a safe manner, protective of public health and the environment. One commenter noted that an important factor is USEC meeting expectations. One commenter stated, however, that USEC has 16 violation notices, more than any other NRC materials licensee. The commenter noted that USEC has been ordered by NRC to pay civil penalties totaling \$378,000. The commenter stated that these past violations warrant exceptional scrutiny of the license application. A commenter stated that the draft EIS should model the impacts associated with uranium enrichment in excess of 10 percent, given USEC’s previous enforcement actions for exceeding its possession limit for such material. Commenters also questioned the viability of USEC to see the project through to completion. Other commenters stated that the draft EIS should critically examine the relationship between DOE and USEC.

Other commenters questioned the credibility of past operators of the site, and indicated that this lack of credibility should be considered when making a licensing decision. A few commenters described the past practices at the site as an indication that safety during past operations was a significant issue. For example, one commenter noted plutonium contamination at the site from past operations, which resulted in monetary compensation for plant workers. Another commenter noted that a 1985 GAO report states that workers at the Piketon Gaseous Diffusion Plant had the highest exposures of all the gaseous diffusion plants. Another commenter indicated that there had been several instances when apparent releases occurred at the site, but no notification was made to the public regarding these releases. One commenter stated that all indications point toward the operation failing and that USEC’s promises will not be fulfilled.

3. SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

The NEPA (Public Law 91-190, as amended), and the NRC’s Implementing Regulations for NEPA (10 CFR Part 51), specify in general terms what should be included in an EIS prepared by the NRC staff. Regulations established by the Council on Environmental Quality (40 CFR

Parts 1500-1508), while not binding on NRC staff, provide useful guidance. Additional guidance for meeting NEPA requirements associated with licensing actions can be found in NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with Office of Nuclear Material Safety and Safeguards (NMSS) Programs."

Pursuant to 10 CFR 51.71(a), in addition to public comments received during the scoping process, the contents of the draft EIS will also address the matters discussed in the USEC Environmental Report. In accordance with 10 CFR 51.71(b), the draft EIS will consider major points of view and objections concerning the environmental impacts of the proposed action raised by other Federal, State, and local agencies, by any affected Indian tribes, and by other interested persons. Pursuant to 10 CFR 51.71(c), the draft EIS will list all Federal permits, licenses, approvals, and other entitlements that must be obtained in implementing the proposed action, and will describe the status of compliance with these requirements. Any uncertainty as to the applicability of these requirements will be addressed in the draft EIS.

Pursuant to 10 CFR 51.71(d), the draft EIS will include a preliminary analysis that considers and weighs the environmental effects of the proposed action; the environmental impacts of alternatives to the proposed action; and alternatives available for reducing or avoiding adverse environmental effects. In the draft analysis, due consideration will be given to compliance with environmental quality standards and regulations that have been imposed by Federal, State, regional, and local agencies having responsibilities for environmental protection. The environmental impact of the proposed action will be evaluated in the draft EIS with respect to matters covered by such standards and requirements, regardless of whether a certification or license from the appropriate authority has been obtained. Compliance with applicable environmental quality standards and requirements does not negate the requirement for NRC to weigh all environmental effects of the proposed action, including the degradation, if any, of water quality, and to consider alternatives to the proposed action that are available for reducing adverse effects. While satisfaction of NRC standards and criteria pertaining to radiological effects will be necessary to meet the licensing requirements of the Atomic Energy Act, the draft EIS will also, for the purposes of NEPA, consider the radiological and nonradiological effects of the proposed action and alternatives.

The following documents are environmental assessments and other EISs which have been prepared that are related to the action under consideration. The following list is not intended to be a comprehensive list:

- Programmatic EIS for Alternative Strategies for the Long-Term Management and Use of Depleted Uranium Hexafluoride (DOE/EIS-0269, March 1999)
- Environmental Assessment of the USEC Inc. American Centrifuge Lead Cascade Facility at Piketon, Ohio (DOE/EA-1495, January 2004)
- Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at the Paducah, Kentucky, Site (DOE/EIS-0359, December 2003)

- Environmental Impact Statement for Construction and Operation of a Depleted Uranium Hexafluoride Conversion Facility at Portsmouth, Ohio Site (DOE/EIS-0360, December 2003)

Pursuant to 10 CFR 51.71(e), the draft EIS will include a preliminary recommendation by the NRC staff with respect to the proposed action. Any such recommendation would be reached after considering the environmental effects of the proposed action and reasonable alternatives, and after weighing the costs and benefits of the proposed action.

The scoping process summarized in this report will help determine the scope of the draft EIS for the proposed facility. The draft EIS will contain a discussion of the cumulative impacts of the proposed action as referenced in NUREG-1748. The development of the draft EIS will be closely coordinated with the SER prepared by the NRC staff to evaluate the health and safety impacts of the proposed action.

One goal in writing the draft EIS is to present the impact analyses in a manner that makes it easy for the public to understand. This draft EIS will provide the basis for the NRC decision with regard to potential environmental impacts. Significant impacts will be discussed in greater detail in the draft EIS, and explanations will be provided for determining the level of detail for different impacts. This should allow readers of the draft EIS to focus on issues that were determined to be important in reaching the conclusions supported by the draft EIS. The following topical areas and issues will be contained within the draft EIS.

- *Alternatives.* The draft EIS will describe and assess the no-action alternative and other reasonable alternatives to the proposed action. Other alternatives may include alternative sites, enrichment sources, or technological alternatives to the proposed centrifuge technology.
- *Need for the Facility.* The draft EIS will provide a discussion of the need for the proposed ACP.
- *Compliance with Applicable Regulations.* The draft EIS will present a listing of the relevant permits and regulations that are believed to apply to the proposed ACP. These would include air, water, and solid waste regulations and disposal permits.
- *Land Use.* The draft EIS will discuss the potential land use impacts associated with the proposed construction, manufacturing, and operating activities.
- *Transportation.* The draft EIS will discuss the impacts associated with the transportation of construction materials, centrifuge parts, feed material, product, and waste tails during both normal transportation and under credible accident scenarios. The impacts on local transportation routes due to workers, delivery vehicles, and waste removal vehicles will be evaluated.
- *Geology and Soils.* The draft EIS will assess the potential impacts to the geology and soils of the proposed ACP site due to soil compaction, erosion, contamination, landslides, and disruption of natural drainage patterns. Evaluation of the potential for

earthquakes or any other major ground motion considerations will be addressed mainly in the SER and only in terms of possible environmental impacts in the draft EIS.

- *Water Resources.* The draft EIS will assess the potential impacts on surface water and groundwater quality and water use due to the proposed action and alternatives.
- *Ecological Resources.* The draft EIS will assess the potential environmental impacts on ecological resources including plant and animal species. Threatened and endangered species and critical habitats will also be discussed, along with the appropriate consultation as required by Section 7 of the Endangered Species Act (16 USC Section 1536(a)(2)). As appropriate, the assessment will include an analysis of mitigation measures to address potential adverse impacts.
- *Air Quality.* The draft EIS will make determinations concerning the meteorological conditions of the site location, the ambient air quality, and the contribution of other sources. In addition, the draft EIS will assess the impacts of the ACP's refurbishment, construction, and operation on local air quality.
- *Noise.* The draft EIS will discuss potential impacts associated with noise levels generated from refurbishment, construction, and operation of the proposed ACP.
- *Historic and Cultural Resources.* The draft EIS will address the potential impacts of the proposed ACP on the historic and archaeological resources of the area. Additionally, as described in a letter dated December 28, 2004 to the Ohio State Historic Preservation Officer, the EIS will also be used to fulfill NHPA Section 106 (36 CFR Part 800) requirements. Potential impacts to the overall visual and scenic character of the facility may also be addressed.
- *Socioeconomics.* The draft EIS will address the demography, economic base, labor pool, housing, utilities, public services, education, and recreation as impacted by the proposed action and alternatives. The hiring of new workers from the outside area could lead to impacts on the regional housing, public infrastructure, and economic resources. Population changes leading to changes to the housing market and demands on the public infrastructure will be assessed.
- *Costs and Benefits.* The draft EIS will address the potential cost/benefits of constructing and operating the ACP, and will discuss the cost/benefits of tails disposition options.
- *Resource Commitments.* The draft EIS will identify the unavoidable adverse impacts and irreversible and irretrievable commitments of resources. It will also address the relationship between local, short-term uses of the environment and the maintenance and enhancement of long-term productivity. Associated mitigative measures and environmental monitoring will be presented, if applicable.
- *Public and Occupational Health.* The draft EIS will include a determination of potentially adverse effects on human health that result from chronic and acute exposures to ionizing radiation and hazardous chemicals as well as from physical safety hazards. These potentially adverse effects on human health might occur during facility refurbishment, construction, or operation. Impacts associated with the implementation

of the proposed action will be assessed under normal operation and credible accident scenarios.

- *Waste Management.* The draft EIS will discuss the management of wastes, including by-product materials, generated from the refurbishment, construction, and operation of the ACP to assess the impacts of generation, storage, and disposal. Onsite storage of wastes will also be included in the assessment.
- *Depleted Uranium Disposal.* The draft EIS will discuss the DUF₆ material, or tails, that results from the enrichment operation over the lifetime of the proposed plant's operation. These concerns include the safe and secure storage and ultimate removal of the material from the site, and the potential conversion of the DUF₆ to U₃O₈ and ultimate disposition.
- *Decommissioning.* The draft EIS will include a discussion of facility decommissioning and associated impacts.
- *Cumulative Impacts.* The draft EIS will address the potential cumulative impacts from past, present, and reasonably foreseeable activities at and near the site
- *Environmental Justice.* The draft EIS will address environmental impacts of the proposed ACP on low-income or minority populations if disproportionately high and if low-income or minority populations are identified. The impacts that could be evaluated include health, ecological (including water quality), social, cultural, and economic resources.

4. ISSUES CONSIDERED TO BE OUTSIDE THE SCOPE OF THE ENVIRONMENTAL IMPACT STATEMENT

The purpose of an EIS is to assess the potential environmental impacts of a proposed action in order to assist in an agency's decision-making process – in this case, NRC's licensing decision. As noted in Section 2.2, some issues and concerns raised during the scoping process are not relevant to the draft EIS because they are not directly related to the assessment of potential impacts or to the decision-making process. The lack of in-depth discussion in the draft EIS, however, does not mean that an issue or concern lacks value. Issues beyond the scope of the draft EIS either may not yet be at the point where they can be resolved, or are more appropriately discussed and decided in other venues.

Some of the issues raised during the public scoping process (e.g., the Carnegie Report, the "Hobson Doctrine," and the "Megatons to Megawatts" program) will not be addressed in the draft EIS. Other issue areas including nonproliferation concerns, security and safety issues (e.g., the domino effect, tornado effects due to climate change), and credibility are also beyond the scope of the EIS. In *The Matter of Private Fuel Storage, LLC* (Independent Spent Fuel Storage Installation), 56 NRC 340 (2002), the Commission held that NRC staff is not required to consider terrorism in its EISs. The Commission indicated, "the possibility of a terrorist attack...is speculative and simply too far removed from the natural or expected consequences of agency action to require a study under NEPA."

Some of the issues raised during the public scoping process for the proposed facility are outside the scope of the draft EIS, but they will be analyzed in the SER. For example, health

and safety issues will be considered in detail in the SER prepared by NRC staff for the proposed action and will be summarized in the EIS. The draft EIS and the SER are related in that they may cover the same topics and may contain similar information, but the analysis in the draft EIS is limited to an assessment of potential environmental impacts. In contrast, the SER primarily deals with safety evaluations and procedural requirements or license conditions to ensure the health and safety of workers and the general public. The SER also covers other aspects of the proposed action such as demonstrating that the applicant will provide adequate funding for the proposed facility in compliance with NRC's financial assurance regulations.

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APPENDIX B
CONSULTATION LETTERS

December 28, 2004

Mr. Mark Epstein, Department Head
Ohio Historic Preservation Office
Resource Protection and Review
567 East Hudson Street
Columbus, OH 43211-1030

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT
SECTION 106 PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Epstein:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium -235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

Two preliminary phase I archaeological surveys and one draft cultural resource report have been completed for the DOE reservation. Archaeological surveys and the cultural report results are discussed section 3.8 of the ER (enclosed). Historical and cultural resource impacts are discussed in section 4.8 of the ER (enclosed).

As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding other parties that may be entitled to be consulting parties by this action. As required by 36 CFR 800.4(a), the NRC is requesting the views of the State Historic Preservation Officer and your office on further actions to identify historic properties that may be affected by the proposed ACP.

M. Epstein

-2-

As part of the EIS preparation, the NRC will be hosting a public scoping meeting on Tuesday, January 18, 2005, at the Zahns Corner Middle School in Piketon from 7:00 - 9:45. The meeting will include NRC staff presentations on the environmental review process, after which members of the public will be given the opportunity to present their comments. This scoping information, along with any information you provide, and material provided by USEC in the ER, will be used to document effects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Chief
Environmental and Performance
Assessment Branch
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

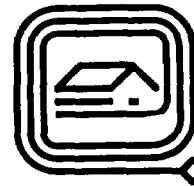
cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

Ohio Historic Preservation Office

567 East Hudson Street
Columbus, Ohio 43211-1030
614/ 298-2000 Fax: 614/ 298-2037

Visit us at www.ohiohistory.org



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February 2, 2005

Ron Linton
Environmental and Performance Assessment Branch
Nuclear Regulatory Commission
Washington, DC 20555-0001

Re: Docket No. 70-7004, American Centrifuge Commercial Plant
Portsmouth Gaseous Diffusion Plant (PORTS), Pike County, Ohio

Dear Mr. Linton,

This is in response to correspondence from your office dated December 28, 2004 (received January 3) regarding the above referenced project. The comments of the Ohio Historic Preservation Office (OHPO) are submitted in accordance with provisions of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 [36 CFR 800]); the Department of Energy serves as the lead federal agency.

Your correspondence initiates consultation by the Nuclear Regulatory Commission (NRC) for the above referenced project. We acknowledge that the NRC will be following regulations at 36 CFR 800.8 in the review process integrating the Section 106 review with the development of the Environmental Report (ER) for this project. Your correspondence also requests information on consulting parties.

This office has previously reviewed information on the proposed project and has responded to the position that the proposed new construction will include buildings of similar design and size to the nearby buildings and that there will be similar functions carried out in these new buildings. Given the available information on the size, design, and function of the existing and the proposed buildings, we were able to offer our opinion that the proposed project will not adversely affect the Portsmouth Gaseous Diffusion Plant historic property.

As you are aware, private citizens have raised concerns about the potential for this project to affect historic properties, including prehistoric archaeological sites. The National Historic Preservation Act encourages federal agencies to include comments and concerns from the public throughout the Section 106 review process.

In addition to other consulting parties that your agency may have identified, we recommend that you consider notifying Native American Federally-Recognized Tribal authorities that are historically associated with south-central Ohio and may have information on historic properties in this area. Attached please find a partial list of Tribes with historical ties to Ohio. We believe that this list may be helpful in finalizing your list of potential consulting parties to whom you will be providing notification of the project.

I think that it is important for you to clearly convey to consulting parties and to the public the extent of the efforts to identify historic properties and to assess the potential for the project to adversely affect historic properties. I am concerned that the discussions in your correspondence and in the attached sections from the draft ER should be clearer and more precise. For example, the archaeological surveys were not preliminary, but their conclusions are preliminary and we are still working at interpreting the results and developing a consensus on the findings. In some cases it might be appropriate to describe an archaeological survey as preliminary, especially when the primary objective of the work for a survey is to

Mr. Ron Linton
February 2, 2005
Page 2

lay the ground work for the next phase of an intended and expected survey. The predictive model work that you reference might be described as preliminary but it also provides important information on the distribution of known sites in the vicinity of the Portsmouth Gaseous Diffusion Plant. Also, at least one additional archaeological study has been conducted within the facility at archaeological site 33-PK-210. This study may not be relevant to this project, but language in the draft ER might lead some to conclude that all of the previous archaeological work is referenced rather than only a portion of the previously completed work. The survey methods employed in the predictive model work are likely quite different from the survey methods employed in identification efforts.

I think that it would be more helpful to describe the conclusions of the Schweikart 1997 archaeological survey as recommendations, not as determinations. In the past we have encountered some confusion in descriptions of known archaeological sites both within and in the general area surrounding the facility. For example, not all archaeological sites with prehistoric components are burial grounds and many archaeological sites are quite small, less than 100 square meters.

Similar kinds of concerns could also be raised concerning the presentation of the information on architectural properties in the Environmental Report.

In summary, it would be helpful for the documentation to provide greater clarity and to provide greater precision to facilitate the integration the discussions on archaeological sites, architectural properties, and other kinds of cultural resources within the overall assessment of effects.

Any questions concerning this matter should be addressed to David Snyder at (614) 298-2000, between the hours of 8 am. to 5 pm. Thank you for your cooperation.

Sincerely,

A handwritten signature in black ink that reads "David Snyder". The signature is written in a cursive, flowing style.

David Snyder, Archaeology Reviews Manager
Resource Protection and Review

DMS/ds (OHPO Serial Number 105834)

Enclosure

To assist you in the event that consultation with federally recognized tribal authorities is needed, OHPO maintains a list of federally recognized tribal authorities including listings from the Bureau of Indian's Affairs' Tribal Leaders Directory. This list is not all-inclusive; it represents a first step in developing procedures to address issues of disposition and repatriation. There are currently no federally recognized tribal authorities in Ohio since Ohio does not have any Native American Reservations or Land. However, there are many active Native American groups and organizations in Ohio. Also, in some cases, the Ohio Historic Preservation Office may be able to assist agencies and individuals contact individuals who have expressed an interest in the issues involving reburial. If the need develops we can provide assistance to get you started in compiling a list of interested parties.

Endnote. For further information, you may wish to contact the following:

Tim McKeown, National Center for Cultural Resources, National Park Service, P.O. Box 37127, Washington, D.C. 20013-7127, (202) 343-1142

Francis McManamon, National Center for Cultural Resources, National Park Service, P.O. Box 37127, Washington, D.C. 20013-7127, (202) 343-4101

The following are representatives of Federally-recognized Tribal Authorities of some tribes having historic connections to Ohio (based on the Tribal Leaders Directory, Bureau of Indian Affairs, Division of Tribal Government Services, January 1992 - for more information phone: 202/208-4400):

Mr. James Leaffe, Chief
Cayuga Nation
P.O. Box 11
Versailles, NY 14168
Attn: Mr. Clint Halftown, THPO
Representative
Telephone: 716-532-4847

Cherokee Nation of Oklahoma
P.O. Box 948
Ada, OK 74820

Turtle Mountain Band of Chippewa Indians
P.O. Box 900
Belcourt, ND 58316
Attn: Mr. Kade M. Ferris, Tribal Historic
Preservation Officer, Office of
Archaeology and Historic
Preservation
THPO: Mr. Kade M. Ferris

Mr. Bruce Gonzales, President
Delaware Tribe of Western Oklahoma
P.O. Box 825
Anardarko, OK 73005
Attn: Ms. Tamara Francis, Delaware
Nation NAGPRA Office
Telephone: 405-247-2448
FAX: 405-247-9393
Email: aapanahkih@westerndelaware.nsn.us

Mr. John Pryor, Executive Officer
Miami Tribe of Oklahoma
P.O. Box 1326
202 South Eight Tribes Trail
Miami, OK 74355
Attn: Ms. Julie Olds, THPO
THPO: Ms. Julie Olds
Telephone: 918-542-1445 X16 (Olds)
FAX: 918-542-7260
Email: jolds@miamination.com

Mr. Charles Todd, Chief
Ottawa Tribe of Oklahoma
P.O. Box 110
Miami, OK 74355
Attn: Mr. Roy Ross
Telephone: 918-540-1536
FAX: 918-542-3214

Mr. John P. Froman, Chief
Peoria Tribe of Oklahoma
P.O. Box 1527
118 S. Eight Tribes Trail
Miami, OK 74355
Attn: Mr. Bud Ellis, Repatriation
Committee Chairman
Telephone: 918-540-2535
FAX: 918-540-2538

Mr. Harold Frank, Chairperson
Forest County Potawatomi
P.O. Box 340
Community of Wisconsin Potawatomi
Crandon, WI 54520
Attn: Ms. Clarice M. Werle, NAGPRA
Contact
Telephone: 715-478-7381 (Werle)
FAX: 715-478-7385

Mr. John A. Barrett, Jr., Chairperson
Citizen Potawatomi Nation
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
Attn: Mr. Jeremy Finch
Telephone: 405-275-3121
FAX: 405-275-0198
800 Number: 800-880-9880

Mr. Calvin John, President
Seneca Nation of Indians
P.O. Box 231
Salamanca, NY 14779
Attn: Ms. Kathleen Mitchell, THPO
THPO: Ms. Kathleen Mitchell
Telephone: 716-945-9427
FAX: 716-945-1989
Email: snithpo@netscape.net

Mr. Jerry Dilliner, Chief
Seneca-Cayuga Tribe of Oklahoma
P.O. Box 1283
R2301 E. Steve Owens Blvd.
Miami, OK 74355
Attn: Mr. Paul Barton
Telephone: 918-542-6609
FAX: 918-542-3684
Email: maimit5@onenet.net

Mr. Charles D. Enyart, Chief
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865
Attn: R.C. Kisse
Telephone: 918-666-2435 X241
FAX: 918-666-3325
Email: estochief@hotmail.com

Mr. James Squirrel
Loyal Shawnee Tribe
Route 4, Box 30
Jay, OK 74346

Mr. Kenneth Daugherty, Tribal Secretary
Absentee-Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, OK 74801-9381
Attn: Ms. Karen Kaniatobe
Telephone: 405-275-4030 X124
FAX: 405-275-1922
Email: jenniferm@astribe.com

Mr. Leaford Bearskin, Chief
Wyandotte Nation
P.O. Box 250
Wyandotte, OK 74370
Attn: Ms. Sherri Clemons

March 14, 2005

Mr. James Leaffe, Chief
Cayuga Nation
P.O. Box 11
Versailles, NY 14168
Attn: Mr. Halftown, THPO
Representative

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Leaffe:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

Two phase I archaeological surveys and one draft cultural resource report have been completed for the DOE reservation. Archaeological surveys and the cultural report results are discussed section 3.8 of the ER (enclosed). Historical and cultural resource impacts are discussed in section 4.8 of the ER (enclosed). The Area of Potential Effects (APE) is defined as the DOE reservation in Piketon, Ohio.

As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

J. Leaffe

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Cherokee Nation of Oklahoma
P.O. Box 948
Ada, OK 74820

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Cherokee Nation of Oklahoma:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

Cherokee Nation of Oklahoma

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Turtle Mountain Band
of Chippewa Indians
Attn: Mr. Kade M. Ferris
Tribal Historic Preservation Officer
Office of Archaeology
and Historic Preservation
P.O. Box 900
Belcourt, ND 58316

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Ferris:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

K. Ferris

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Bruce Gonzales, President
Delaware Tribe of Western Oklahoma
P.O. Box 825
Anardarko, OK 73005
Attn: Ms. Tamara Francis, Delaware
Nation NAGPRA Office

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Gonzales:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

B. Gonzales

-2-

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. John Pryor, Executive Officer
Miami Tribe of Oklahoma
P.O. Box 1326
202 South Eight Tribes Trail
Miami, OK 74355
Attn: Ms. Julie Olds, THPO

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Pryor:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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J. Pryor

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Charles Todd, Chief
Ottawa Tribe of Oklahoma
P.O. Box 110
Miami, OK 74355
Attn: Mr. Roy Ross

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Todd:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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C. Todd

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. John P. Froman, Chief
Peoria Tribe of Oklahoma
P.O. Box 1527
118 S. Eight Tribes Trail
Miami, OK 74355
Attn: Mr. Bud Ellis, Repatriation
Committee Chairman

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Froman:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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J. Forman

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Harold Frank, Chairperson
Forest County Potawtomi
P.O. Box 340
Community of Wisconsin Potawtomi
Crandon, WI 54520
Attn: Ms. Clarice M. Werle, NAGPRA
Contact

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Frank:

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H. Frank

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. John A. Barret, Jr., Chairperson
Citizen Potawatomi Nation
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
Attn: Mr. Jeremy Finch

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Barrett:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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J. Barrett

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 16, 2005

Mr. Calvin John, President
Seneca Nation of Indians
P.O. Box 231
Salamanca, NY 14779
Attn: Ms. Kathlenn Mitchell, THPO

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. John:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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C. John

- 2 -

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Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Jerry Dilliner, Chief
Seneca-Cayuga Tribe of Oklahoma
P.O. Box 1283
R2301 E. Steve Owens Blvd.
Miami, OK 74355
Attn: Mr. Paul Barton

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Dilliner:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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J. Dilliner

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Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Charles D. Enyart, Chief
Eastern Shawnee Tribe of Oklahoma
P.O. Box 350
Seneca, MO 64865
Attn: R.C. Kissee

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Enyart:

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C. Enyart

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
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Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Kenneth Daughtery, Tribal Secretary
Absentee-Shawnee Tribe of Oklahoma
2025 S. Gordon Cooper Drive
Shawnee, OK 74801-9381
Attn: Ms. Karen Kaniatobe

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Daughtery:

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K. Daughtery

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. James Brushart
President, Pike County Commissioners
230 Waverly Plaza, Suite 1000
Waverly, Ohio 45690

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Brushart:

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J. Brushart

- 2 -

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Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. Leaford Bearskin, Chief
Wyandotte Nation
P.O. Box 250
Wyandotte, OK 74370
Attn: Ms. Sherri Clemons

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Bearskin:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

L. Bearskin

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 14, 2005

Mr. James Squirrel
Loyal Shawnee Tribe
Route 4, Box 30
Jay, OK 74346

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Squirrel:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

J. Squirrel

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 18, 2005

Mr. Ron Sparkman
Shawnee Tribe
P.O. Box 189
Miami, OK 74355

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Sparkman:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

R. Sparkman

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report

March 18, 2005

Mr. Rey Kitchkumme
Prairie Band of Potawatomi Nation
16277 Q Road
Mayetta, KS 66509-8970

SUBJECT: INITIATION OF THE NATIONAL HISTORIC PRESERVATION ACT SECTION 106
CONSULTATION PROCESS FOR THE PROPOSED AMERICAN CENTRIFUGE
COMMERCIAL PLANT, PIKE COUNTY, OHIO

Dear Mr. Kitchkumme:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The NRC is in the initial stages of developing an Environmental Impact Statement (EIS) for the proposed facility to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an EIS for the ACP. The proposed facility will use gas centrifuge technology to enrich the isotope Uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the facility.

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As required by 36 CFR 800.3 (f), the NRC is requesting any information you may have regarding historic sites or cultural resources within the APE. The NRC is interested in knowing if you have specific knowledge of any sites that you believe have traditional religious and cultural significance. In addition, we are interested in knowing if you are aware of or are concerned for any site, or object, eligible for inclusion on the National Register of Historic Places. This will assure appropriate consideration in the Section 106 process.

Any information you provide may be used to document affects in accordance with 36 CFR 800.4 and 800.5. Additionally, we intend to use the EIS process for Section 106 purposes as described in 36 CFR 800.8.

R. Kitchkumme

- 2 -

If you any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental and Low-Level
Waste Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosure: Section 3.8 and 4.8 Environmental Report



PEORIA TRIBE OF INDIANS OF OKLAHOMA

118 S. Eight Tribes Trail (918) 540-2535 FAX (918) 540-2538

P.O. Box 1527

MIAMI, OKLAHOMA 74355

RDB

CHIEF
John P. Froman

SECOND CHIEF
Joe Goforth

March 23, 2005

12/29/04

69FR 78258

①

Chief, Rules and Directives Branch
Division of Administrative Services
Mail Stop T-6 D59
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Initiation of the National Historic Reservation Act Section 106 Consultation Process for the Proposed American Centrifuge Commercial Plant, Pike County, Ohio

Thank you for notice of the referenced project. The Peoria Tribe of Indians of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to the proposed construction. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Peoria Tribe request notification and further consultation.

The Peoria Tribe has no objection to the proposed construction. However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.

John P. Froman
Chief

xc: Bud Ellis, Repatriation/NAGPRA Committee Chairman

SISP Review Complete

FRIDS = ADM-03

Call = M. Blevins (MX06)

TREASURER
John Sharp

SECRETARY
Hank Downum

FIRST COUNCILMAN
Claude Landers

SECOND COUNCILMAN
Jenny Rampey

THIRD COUNCILMAN
Jason Dollarhide

Template = ADM-013

J. Faraz (XHF)

From: "Eastern Shawnee Tribe Chief Enyart" <estochief@hotmail.com>
To: <rc11@nrc.gov>
Date: 6/3/05 4:52PM
Subject: 106 Consultation

June 3, 2005

RE: PROPOSED AMERICAN CENTRIFUGE COMMERCIAL PLANT, PIKE COUNTY, OH

To Whom It May Concern:

Thank you for notice of the referenced project(s). The Eastern Shawnee Tribe of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to the proposed construction. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Eastern Shawnee Tribe request notification and further consultation.

The Eastern Shawnee Tribe has no objection to the proposed construction. However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.

Sincerely,
Jo Ann Beckham, Administrative Assistant
Eastern Shawnee Tribe of Oklahoma



Seneca Nation Tribal Historic Preservation

Kathleen J. Mitchell
Officer

467 Center St. Salamanca, NY 14779
Phone: (716) 945-9427 • Fax: (716) 945-0351
E-mail: snithpo@nycountry.com

Lana K. Watt
Cultural Resource Tech.

April 5, 2005

Attention: Mr. Ron Linton
MS T7 J08
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Proposed American Centrifuge Commercial Plant, Pike County, Ohio

Dear Mr. Linton,

Our office has completed a review of submitted information regarding the above referenced project proposal. In order to further facilitate our review of the project we are requesting that copies of the Phase I Archaeological/Cultural Reports, along with any completed Phase II reports, be forwarded to our office at your earliest convenience.

These comments are offered to assist in compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (36 CFR-80).

Respectfully,

Kathleen Mitchell

Kathleen Mitchell

Tribal Historic Preservation Officer of the Western Dept.

May 20, 2005

ACHP, Office of Federal Agency Programs
Attention: Don Klima, Director
1100 Pennsylvania Avenue NW, Suite 809
Washington, D.C. 20004

SUBJECT: COORDINATION OF NATIONAL HISTORIC PRESERVATION ACT
SECTION 106 REQUIREMENTS AND NATIONAL ENVIRONMENTAL POLICY
ACT REVIEW FOR THE PROPOSED AMERICAN CENTRIFUGE PLANT, PIKE
COUNTY, OHIO

Mr. Klima:

The United States Nuclear Regulatory Commission (NRC) has received a license application from USEC, Inc. (USEC) for the construction, operation, and decommissioning of a gas centrifuge uranium enrichment facility known as the American Centrifuge Plant (ACP). The proposed facility is to be located at the Department of Energy (DOE) reservation in Piketon, Ohio. USEC's license application contained an Environmental Report (ER) that will be used to support the NRC's development of an environmental impact statement (EIS) as required by the NRC's National Environmental Policy Act (NEPA) implementing regulations. The proposed facility will use gas centrifuge technology to enrich the isotope uranium-235 in uranium hexafluoride (UF₆), up to 10-weight percent. The proposed ACP will have a design capacity of seven million separative work units. The forthcoming EIS will document the impacts associated with the construction, operation, and decommissioning of the proposed facility.

Two preliminary phase I archaeological surveys and one draft cultural resource report have been completed for the DOE reservation. Archaeological surveys and the cultural report results are discussed in section 3.8 of USEC's ER (enclosed). Historical and cultural resource impacts are discussed in section 4.8 of USEC's ER (enclosed).

As described in 36 CFR 800.8 we are notifying you that we intend to use the NRC's NEPA review process for Section 106 purposes. In using the NRC's NEPA process in lieu of the procedures set forth in 36 CFR 800.3 through 800.6 we will ensure the standards set forth in 800.8(c)(1) through 800.8(c)(5) are met.

We have previously notified the Ohio State Historical Preservation Officer of our intent to utilize the NRC's NEPA review process to comply with Section 106 requirements in a letter dated December 28, 2004 (enclosed). Additionally, we have solicited information from 17 Indian tribes and one local official in letters dated March 14, 2005 and March 18, 2005. Also, as part of our NEPA review process, we hosted a NEPA public scoping meeting on January 18, 2005, in Piketon, Ohio. At this meeting, we solicited information on cultural and historic properties. A full transcript of this meeting as well as all project related correspondence is available at the NRC's public web site: <http://www.nrc.gov/reading-rm/adams.html>.

We plan to issue the draft EIS in September 2005 and will include you in our distribution. If you have any questions or comments, or need additional information, please contact Ron Linton at (301) 415-7777.

Sincerely,

/RA/

B. Jennifer Davis, Section Chief
Environmental Review Section
Division of Waste Management
and Environmental Protection
Office of Nuclear Material Safety
and Safeguards

Docket No.: 70-7004

cc: USEC Service List

Enclosures:

1. Section 3.8 and Section 4.8 of USEC's Environmental Report (ML043550029)
2. December 28, 2004 letter to Ohio SHPO (ML043520095)

1
2

APPENDIX C
RADIOLOGICAL DOSE ANALYTICAL METHODOLOGY

APPENDIX C

RADIOLOGICAL DOSE ANALYTICAL METHODOLOGY

This appendix discusses the following topics:

- The dose assessment analysis for site preparation and construction activities for the proposed ACP; and
- Environmental transport and calculation of dose and risk.

C.1 Radiological Impacts from Site Preparation and Construction

Radiological impacts during site preparation and construction are primarily to the construction workers performing those activities. Exposures to off-site personnel are greatly below those of the construction workers themselves because of atmospheric dispersion of airborne material and distance from sources of external dose.

C.1.1 Dose to Construction Workers During Site Preparation and Construction

The primary modes of exposure for construction personnel are: (1) inhalation of radionuclides that are in the dust suspended by construction activities; (2) external exposure from radionuclides contained in the soil suspended in the air; (3) external exposure from radionuclides in the soil on the ground; and (4) external exposure from existing sources nearby on the site.

C.1.1.1 Construction Worker Exposure from Inhalation of Radionuclides in Air

The dose and risk calculation for inhalation is based on the methods of Federal Guidance Report 13 (EPA, 1999), which are themselves based on the models recommended by the International Commission on Radiological Protection. In this method, the computation of committed effective dose equivalent for a nuclide is arrived at by computing the intake quantity of the nuclide and multiplying that amount by a coefficient that converts intake quantity to committed effective dose equivalent.

The following linear exposure model will be used to calculate inhalation dose of the i th radionuclide from inhalation:

$$DSR_{inh,i} = \frac{B \times C_d \times DCF_i}{F_p} \quad (\text{Eq. 1})$$

where:

- B = the volume of air inhaled per hour (m^3/hr)
- C_d = the concentration of respirable dust in the air (g/m^3)
- DCF_i = the adult inhalation dose conversion factor of radionuclide i from Federal Guidance Report 13 (mrem/pCi)
- F_p = the assigned protection factor for respirators from 10 CFR 20 Appendix A (NRC, 1991)

Dose Conversion Factors in Federal Guidance Report 13 are a function of not just the radionuclide, but also the inhalation Type. The Type classification scheme, introduced in International Commission on Radiation Protection Publication 66 (ICRP, 1994), replaced the inhalation Class nomenclature previously used in most inhalation dose modeling. Inhalation Type is one of three values, F, M, or S. The dose conversion factor selected for a nuclide in this analysis will be the default recommended Type listed in

1 Federal Guidance Report 13 if one exists. If a default recommended Type does not exist, then Type M
2 will be used.

3
4 For a few elements, the Dose conversion factor is also a function of the chemical state. For example, the
5 Dose conversion factor for tritium (H-3) in Federal Guidance Report 13 is not only a function of Type,
6 but also a function of whether the tritium is bound as a particulate, water vapor, organic, or in an
7 elemental state. The element of interest in this analysis is uranium, for which Federal Guidance Report
8 13 has dose factors for only the particulate state.

9
10 Federal Guidance Report 13 contains dose conversion factors as a function of age. This analysis uses the
11 adult dose conversion factors since all workers are expected to be over the age of 18. Federal Guidance
12 Report 13 also contains risk coefficients for both mortality and morbidity that are analogous to the Dose
13 Conversion Factors. An inhalation mortality risk for each isotope can be calculated using the same
14 equation, but replacing the Dose Conversion Factor for an isotope with an analogous mortality risk
15 coefficient from Federal Guidance Report 13.

16
17 The total inhalation dose from all radionuclides can be estimated by summing all the inhalation doses
18 from the individual radionuclides.

19
20
$$Total\ Inhalation\ Dose = E_d \sum (DSR_{inh,i} \times A_i) \quad (Eq. 2)$$

21
22 where

- 23 A_i = the activity concentration of radionuclide i in dust (pCi/g)
24 E_d = the number of hours per year that the worker is exposed (hr/yr)
25

26 The inhalation analysis uses the following parameters, which provide for an analysis that should produce
27 a high estimate of dose:

- 28
29 • 40 hours/week exposure, 48 weeks per year at job site (52 less 2 vacation and 2 weeks equivalent for
30 holidays/sick time);
31
32 • No respiratory protection ($F_p = 1$);
33
34 • Breathing Rate is 1.4 cubic meters per hour from EPA Exposure Factors Handbook (EPA, 1997);
35
36 • The average uranium concentration in soil is 7.7 micrograms per gram soil from Table 3.3.2-1 in the
37 ACP Environmental Report (USEC, 2004);
38
39 • On-site air contains 313 micrograms of soil per cubic meter (maximum hourly concentration from
40 construction air modeling results);
41
42 • All the soil in the air comes from on-site soil with the average uranium concentrations; there is no
43 contribution from off-site;
44
45 • The uranium in the soil is Type F for selecting inhalation dose conversion factors, technicium-99 is
46 type S. These provide the maximum dose conversion factors;
47
48 • Technicium-99 activity in soil is one half of the maximum value in Table 3.3.2-1 of USEC, 2005; and
49
50 • All radioactive materials in the air exist in a fully respirable particle size.

The isotopic activity ratio for the site should average to approximately natural uranium. The mass fractions for the various isotopes of uranium are thus expected to be 0.9926 uranium-238, 0.0073 uranium-235, and 0.000054 uranium-234. The activity ratio is then the specific activity times the mass fraction as seen in Table C-1:

Table C-1 Site Isotopic Activity Ratio

Isotope	Mass Fraction	Specific Activity Ci/gram	Activity Ratio	Activity in Soil pCi/gram
U-234	5.4×10^{-5}	6.2×10^{-3}	3.4×10^{-7}	2.59
U-235	7.3×10^{-3}	2.2×10^{-6}	1.6×10^{-8}	0.12
U-238	9.9×10^{-1}	3.4×10^{-7}	3.3×10^{-7}	2.57
Tc-99	--	--	--	6.3

Notes:

Ci = curie; pCi = picocurie.

Information on isotopic ratios of natural uranium and specific activity is from the Chart of the Nuclides, Twelfth Edition, General Electric Company, San Jose, CA, 1977.

The uranium activity concentration in soil is then calculated from

$$A_i = 10^{12} \times AR_i \times C \quad (\text{Eq. 3})$$

where:

- A_i = the isotopic activity in soil in pCi/gram for isotope i ;
- AR_i = the activity ratio for isotope i in Ci/gram of uranium;
- C = the concentration of uranium in the soil in microgram U/gram soil;
- 10^{12} = a factor to convert Ci to pCi.

Table C-2 describes the resulting dose from inhalation by isotope:

Table C-2 Inhalation Dose by Isotope

Isotope	Type	Dose Conversion Factor (mrem/pCi)	Dose (mrem/yr)
U-234	F	2.1×10^{-3}	4.5×10^{-3}
U-235	F	1.9×10^{-3}	1.9×10^{-4}
U-238	F	1.9×10^{-3}	4.0×10^{-3}
Tc-99	S	4.9×10^{-5}	2.6×10^{-4}
Total			9.0×10^{-3}

Notes:

mrem = millirem; pCi = picocurie; yr = year.

C.1.1.2 Construction Worker Exposure from Submersion

Dose to construction workers will occur from external exposure to radiation emitted by radionuclides that are in soil where the construction activities are taking place. The dominant sub-pathways for exposure to these radionuclides include air submersion and direct soil exposure. These exposures can be calculated using a method similar to that used for inhalation:

$$DSR_{sub,i} = C_d \times DCF_{sub,i} \quad (\text{Eq. 4})$$

$DCF_{sub,i}$ is in units of millirem per Ci-yr per meter cubed.

With the DSR known, the submersion dose can then be calculated from:

$$\text{Total Dose from Submersion} = E_D \sum_i (DSR_{sub,i} \times A_i) \quad (\text{Eq. 5})$$

The dust concentrations and exposure times are the same as those used for inhalation. Table C-3 describes the dose to workers from submersion.

Table C-3 Worker Dose from Dust Submersion

Isotope	Dose Conversion Factor (mrem-m ³ /Ci-yr)	Submersion Dose (mrem/yr)
U-234	$7.2 \times 10^{+05}$	4.1×10^{-09}
U-235	$7.6 \times 10^{+08}$	2.0×10^{-07}
U-238	$2.9 \times 10^{+05}$	1.7×10^{-09}
Tc-99	$3.4 \times 10^{+06}$	4.6×10^{-08}
Total		2.5×10^{-07}

Notes:

mrem-m³ = millirem-cubic meter; Ci-yr = curie-year; mrem/yr = millirem per year.

C.1.1.3 Construction Worker External Dose from Radionuclides in Soil

Workers will also be subject to exposure from exposure to radionuclides in the soil. Dose from this exposure is calculated using the equation:

$$DSR_{ext,i} = C_s \times DCF_{ext,i} \quad (\text{Eq. 6})$$

$DCF_{ext,i}$ is the Dose conversion factor for exposure to external radiation in soil, is in units of millirem per pCi-yr per gram.

The exposure time and soil concentrations used are identical to those used in the inhalation calculation. Again, with the DSR known the total external dose from radionuclides in soil can be calculated from:

$$\text{Total Dose from Radionuclides in Soil} = E_D \sum_i (DSR_{ext,i} \times A_i) \quad (\text{Eq. 7})$$

Table C-4 describes the total external dose to workers from radionuclides in soil.

Table C-4 Total Worker External Dose from Soil

Isotope	Dose Conversion Factor (mrem-g/pCi-yr)	External Dose (mrem/yr)
U-234	3.4×10^{-04}	2.0×10^{-04}
U-235	6.6×10^{-01}	1.7×10^{-02}
U-238	8.0×10^{-05}	4.5×10^{-05}
Tc-99	1.1×10^{-04}	1.5×10^{-04}
Total		1.8×10^{-02}

Notes:

mrem-g = millirem per gram; pCi-yr = picocurie-year; mrem/yr = millirem per year.

C.1.1.4 Construction Worker External Dose from Existing Sources

DOE has maintained a set of thermoluminescent dosimeters both on and offsite to measure the direct radiation exposure at various locations from the totality of on-site sources, including the cylinder storage pads and other secondary sources. Thermoluminescent dosimeters provide the best estimate of the external radiation exposure rates at various locations around the site. Work related to the proposed ACP is expected to occur primarily at and around the existing X-3001 and X-3002 buildings, with some additional work being done to build the new X-745H cylinder storage pad approximately 200 yards north of the existing X-745G cylinder storage pad.

In 2003 the environmental exposure rate in the vicinity of the X-3001 and X-3002 buildings was approximately 20 millirem per quarter based on the thermoluminescent dosimeter in that region, TLD 1404A (DOE, 2004). Environmental thermoluminescent dosimeters record information around the clock, or about 2,190 hours per quarter. Assuming a 40 hour work week for a thirteen week quarter, a construction worker in the vicinity of the X-3001 or X-3002 buildings would receive a maximum external radiation dose of 0.5 millisieverts (5 millirem) per quarter or 0.20 millisieverts (20 millirem) per year.

The ambient dose rate in the vicinity of the X-745H cylinder storage pad is expected to be greater than that near the X-3001 and X-3002 buildings. Thermoluminescent dosimeters near the existing storage yards show wide variance in their measured exposure rates; for example, the three thermoluminescent dosimeters nearest the expected location of the X-745H pad record exposure rates at approximately 20 millirem per quarter, while others slightly farther away record higher values, with one thermoluminescent dosimeter reading a value as high as 1.87 millisieverts (187 millirem) per quarter (DOE, 2004). The variation is the result of a number of factors, including the distance and geometry of the thermoluminescent dosimeter relative to the existing storage yards, and any work that may have temporarily placed a source in the vicinity of the thermoluminescent dosimeter. Using a very conservative assumption that the exposure rate at the X-745H construction site is 1 millisievert (100 millirem) per quarter (4 millisieverts [400 millirem] per year), a construction worker working 40 hours per week for 48 weeks at that job site would receive a maximum external dose of approximately 88 millirem for the year, which is below the public dose limit of 1 millisievert (100 millirem) per year contained in 10 CFR 20.1301(a)(1). The most likely radiation dose to workers at the X-745H pad is expected to be much less, on the order of 0.20 millisieverts (20 millirem) per year, based on the readings from the nearby thermoluminescent dosimeters and the fact that the average annual dose for storage pad workers was 0.29 millisieverts (29 millirem) in 2003. A dose of 0.20 millisieverts (20 millirem), is on the same scale as the variations in individual dose caused by the fluctuation in natural background.

Background radiation dose in the United States averages approximately 3.6 millisieverts (360 millirem) per year (NRC, 2005).

The estimate for external dose from other sources is, for a number of reasons, likely to be significantly exaggerated relative to any actual dose received by a construction worker. First, construction of the pad is not expected to last a full calendar year even though the dose estimate assumes an annual exposure period. Second, the analysis implicitly assumes the same personnel are used in the higher dose rate area for the entire year regardless of the fact that the specific tasks may be changing (i.e. grading versus pouring concrete). Third, the analysis assumes that these personnel spend 100 percent of their work time in the higher dose rate region. The analysis is useful in demonstrating that even with these assumptions in place the maximum dose would still be below the applicable NRC public dose limit.

C.1.1.5 Total Potential Dose to Construction Workers

Total occupational exposures from all four pathways are expected to be less than 1 millisievert (100 millirem) per year, even for estimates combining the most conservative analytical assumptions. This dose presents a nearly negligible risk, representing a lifetime excess cancer risk of approximately 5×10^{-6} when using a risk coefficient of 5×10^{-4} risk per rem (EPA, 1994). Based on this assessment, the impact to workers, from radiological exposure during site preparation and construction is SMALL.

C.1.2 Dose to Off-Site Public from Site Preparation and Construction

Exposures to off-site personnel will be significantly smaller than that for construction workers, particularly since off-site personnel will not have any potential for measurable exposure from the depleted uranium storage pads. The off-site public will also not be exposed to dose from on-site soil containing concentrations of radionuclides above background concentrations.

Estimates of dose to the off-site public from site preparation and construction are limited to two of the pathways used in the analysis of dose to construction workers, inhalation and air submersion. The methodology used to calculate inhalation and submersion dose to the offsite public is the same as that used to calculate the doses to construction workers; only the concentration of dust in air and the exposure duration in hours per year are changed. The airborne dust concentration used in the off-site inhalation exposure is 22.7 micrograms per cubic meter, which represents the maximum fence-line one hour concentration. The exposure duration is considered to be 8,760 hours per year, or full time occupancy. Using these values in the previous models results in the following inhalation dose values in millirem per year of exposure (Table C-5):

Table C-5 Dose to the Off-Site Public

Isotope	Inhalation Dose (mSv/yr)	Submersion Dose (mSv/yr)
U-234	4.5×10^{-05}	0
U-235	1.9×10^{-06}	0
U-238	4.0×10^{-05}	0
Tc-99	2.6×10^{-06}	0
Total	8.9×10^{-05}	0

Notes:

mSv/yr = millisievert per year.

To convert millisievert to millirem multiply by 100.

The maximum exposure to off-site personnel is estimated to be much less than 0.01 millisieverts (1millirem) per year, so the impact to off-site personnel from site preparation and construction is SMALL.

C.2 Estimation of Dose and Risk

The purpose of this section is to present the mathematical models and equations used in CAP88-PC for environmental transport and estimation of dose and risk from air transport of radioactive material.

C.2.1 Environmental Transport

CAP88-PC incorporates a modified version of the AIRDOS-EPA (Moore, 1979) program to calculate environmental transport. Relevant portions of this document are reproduced here, as referenced.

C.2.1.1 Plume Rise

CAP88-PC calculates plume rise in the subroutine CONCEN using either Rupp's equation (Ru48) for momentum dominated plume rise, or Briggs' equations (Br69) for hot buoyant plumes (Mo79). CAP88-PC also accepts user-supplied values for plume rise for each Pasquill stability class. The plume rise, Δh , is added to the actual physical stack height, h , to determine the effective stack height, H . The plume centerline is shifted from the physical height, h , to H as it moves downwind. The plume centerline remains at H unless gravitational settling of particulates produces a downward tilt, or until meteorological conditions change.

Rupp's equation for momentum dominated plumes is:

$$\Delta h = \frac{1.5vd}{\mu} \quad (\text{Eq. 1})$$

where:

- Δh = plume rise
- v = effluent stack gas velocity (m/sec)
- d = inside stack diameter (m)
- μ = wind velocity (m/sec)

CAP88-PC models Briggs' buoyant plume rise for stability categories A, B, C, and D with:

$$\Delta h = \frac{1.6 F^{1/3} x^{2/3}}{\mu} \quad (\text{Eq. 2})$$

where:

- Δh = plume rise
- F = $3.7 \times 10^{-5} Q_H$
- Q_H = heat emission from stack gases (cal/sec)
- x = downwind distance (m)
- μ = wind speed (m/sec)

This equation is valid until the downwind distance is approximately ten times the stack height, 10h, where the plume levels off. For downwind distances greater than 10h, the equation used is:

$$\Delta h = \frac{1.6 F^{1/3} x (10h)^{2/3}}{\mu} \quad (\text{Eq. 3})$$

Equation (2) is also used to a distance of $X = 2.4 \mu S^{-1/2}$ for stable categories E, F, and G, beyond which the plume is assumed to level off. For higher values of x, the stability parameter, S, is used in the equation:

$$\Delta h = 2.9 (F/\mu S)^{1/3} \quad (\text{Eq. 4})$$

in which:

$$\begin{aligned} S &= (g/T_a)(dT_a/dz+G) \\ g &= \text{gravitational acceleration (m/sec}^2\text{)} \\ T_a &= \text{air temperature (}^\circ\text{K)} \\ dT_a/dz &= \text{vertical temperature gradient (}^\circ\text{K/m)} \\ z &= \text{vertical distance above stack (m)} \\ G &= \text{adiabatic lapse rate of atmosphere (0.0098}^\circ\text{K/m)} \end{aligned} \quad (\text{Eq. 5})$$

The value of the vertical temperature gradient, dT_a/dz , is positive for stable categories. In CAP88-PC, dT_a/dz values are:

7.280E-02 °K/m for Pasquill category E
1.090E-01 °K/m for Pasquill category F
1.455E-01 °K/m for Pasquill category G

The true-average wind speed for each Pasquill stability category is used in CAP88-PC to estimate plume rise, as it is greater than the reciprocal-averaged wind speed, and produces a smaller, more conservative plume rise. This procedure does not risk underestimating the significant contribution of relatively calm periods to downwind nuclide concentrations which could result from direct use of a plume rise calculated for each separate wind-speed category. This procedure avoids calculating an infinite plume rise when wind speed is zero (during calms), since both momentum and buoyancy plume rise equations contain wind speed in the denominator (Moore, 1979).

CAP88-PC also accepts user-supplied plume rise values, for situations where actual measurements are available or the supplied equations are not appropriate. For example, plume rises of zero may be used to model local turbulence created by building wakes.

For this analysis, the plume rise was set to zero for each Pasquill category.

C.2.1.2 Plume Dispersion

Plume dispersion is modeled with the Gaussian plume equation of Pasquill (Pasquill, 1961, and Moore, 1979), as modified by Gifford:

$$\chi = \frac{Q}{2\pi\sigma_y\sigma_z\mu} \exp[-1/2(y/\sigma_y)^2] \{ \exp[-1/2((z-H)/\sigma_z)^2] + \exp[-1/2((z+H)/\sigma_z)^2] \} \quad (\text{Eq. 6})$$

where:

χ = concentration in air (chi) at x meters downwind, y meters crosswind, and z meters above ground (Ci/m³)

Q = Release rate from stack (Ci/sec)

μ = wind speed (m/sec)

σ_y = horizontal dispersion coefficient (m)

σ_z = vertical dispersion coefficient (m)

H = effective stack height (m)

y = crosswind distance (m)

z = vertical distance (m)

The downwind distance x comes into Equation (6) through σ_y and σ_z , which are functions of x as well as the Pasquill atmospheric stability category applicable during emission from the stack. CAP88-PC converts χ in Equation (6) and other plume dispersion equations from units of curies per cubic meter to units of picocuries per cubic centimeter.

Annual-average meteorological data sets usually include frequencies for several wind-speed categories for each wind direction and Pasquill atmospheric stability category. CAP88-PC uses reciprocal-averaged wind speeds in the atmospheric dispersion equations, which permit a single calculation for each wind-speed category. Equation (6) is applied to ground-level concentrations in air at the plume centerline by setting y and z to zero, which results in:

$$\chi = \frac{Q}{\pi \sigma_y \sigma_z \mu} \exp[-1/2(H/\sigma_z)^2] \quad (\text{Eq. 7})$$

The average ground-level concentration in air over a sector of 22.5° can be approximated by the expression:

$$\chi_{ave} = f\chi \quad (\text{Eq. 8})$$

where f is the integral of the exponential expression:

$$\exp[-1/2(y/\sigma_y)^2]$$

in Equation (6) from a value of y equals zero to infinity divided by y_s , the value of y at the edge of the 22.5° sector, which is the value of the downwind distance, x, multiplied by the tangent of half the sector angle. The expression is:

$$f = \frac{\int_0^{\infty} \exp\left[-\left(\frac{0.5}{\sigma_y^2}\right)y^2\right] dy}{y_s} \quad (\text{Eq. 9})$$

The definite integral in the numerator of Equation (9) is evaluated as

$$\sigma_y (\pi/2)^{1/2}$$

Since $y_s = x \tan (11.25^\circ)$,

$$f = \frac{6.300836 \sigma_y}{x} \quad (\text{Eq. 10})$$

The equation for sector-averaged ground level concentration in air is therefore:

$$\chi = \frac{Q}{0.15871 \pi x \sigma_z \mu} \exp[-1/2(H/\sigma_z)^2] \quad (\text{Eq. 11})$$

This method of sector-averaging compresses the plume within the bounds of each of the sixteen 22.5° sectors for unstable Pasquill atmospheric stability categories in which horizontal dispersion is great enough to extend significantly beyond the sector edges. It is not a precise method, however, because the integration over the y-axis, which is perpendicular to the downwind direction, x, involves increasing values for x as y is increased from zero to infinity.

An average lid for the assessment area is provided as part of the input data. The lid is assumed not to affect the plume until x becomes equal to $2x_L$, where x_L is the value of x for which $\sigma_z = 0.47$ times the height of the lid (Turner, 1969). For values of x greater than $2x_L$, vertical dispersion is restricted and radionuclide concentration in air is assumed to be uniform from ground to lid.

The average concentration between ground and lid, which is the ground-level concentration in air for values of x greater than $2x_L$, may be expressed by:

$$\chi_{ave} = \int_0^L \frac{\chi}{L} dz \quad (\text{Eq. 12})$$

where χ is taken from Equation (6) and L is lid height. The value of H in Equation (6) may be set at zero since χ_{ave} is not a function of the effective stack height.

The resulting simplified expression may be evaluated for constant x and y values (s_y and s_z held constant) by using a definite integral similar to that in Equation (10):

$$\chi_{ave} = \left(\frac{1}{L}\right) \int_0^L \left(\frac{Q}{\pi \sigma_y \sigma_z}\right) \exp\left(\frac{-Z^2}{2\sigma_z^2}\right) \exp\left(\frac{-Z^2}{2\sigma_y^2}\right) dz \quad (\text{Eq. 13})$$

The result is:

$$\chi_{ave} = \frac{Q}{2.5066 \sigma_y L \mu} \exp[-y^2/\sigma_y^2] \quad (\text{Eq. 14})$$

One obtains the sector-averaged concentration at ground level by replacing the exponential expression containing y by f in Equation (11):

$$\chi_{ave} = Q/0.397825xL\mu \quad (\text{Eq. 15})$$

It should be noted at this point that for values of the downwind distance greater than $2x_L$ dispersion, as expressed in Equation (16), no longer can be said to be represented by the Pasquill equation. The model is simply a uniform distribution with a rectangle of dimensions LID and $2x \tan (11.25^\circ)$.

Gravitational settling is handled by tilting the plume downward after it has leveled off at height H by subtracting $V_g x/m$ from H in the plume dispersion equations. For CAP88-PC V_g is set at the default value of zero and cannot be changed by the user.

C.2.1.3 Dry Deposition

Dry deposition is modeled as being proportional to the ground-level concentration of the radionuclide (Moore, 1979):

$$R_d = V_d \chi \quad (\text{Eq. 16})$$

where:

$$\begin{aligned} R_d &= \text{surface deposition rate (pCi/cm}^2\text{-sec)} \\ V_d &= \text{deposition velocity (cm/sec)} \\ \chi &= \text{ground-level concentration (chi) in air (pCi/cm}^3\text{)} \end{aligned}$$

Although V_d has units of velocity, it is only a proportionality constant and is usually higher than the actual, measured velocity of radionuclides falling to the ground. The proportionality constant must include deposition from fallout interception by foliage, which subsequently falls to the ground and so adds to ground deposition. Defaults for deposition velocity used by CAP88-PC are 3.5×10^{-02} meters per second for Iodine, 1.8×10^{-03} meters per second for particulates, and zero for gases.

C.2.1.4 Precipitation Scavenging

The deposition rate from precipitation scavenging (Moore, 1979), which occurs when rain or snow removes particles from the plume, is modeled with:

$$R_s = \Phi \chi_{ave} L \quad (\text{Eq. 17})$$

where:

$$\begin{aligned} R_s &= \text{surface deposition rate (pCi/cm}^2\text{-sec)} \\ \Phi &= \text{scavenging coefficient (sec}^{-1}\text{)} \\ \chi_{ave} &= \text{average concentration in plume up to lid height (pCi/cm}^3\text{)} \\ L &= \text{lid height (tropospheric mixing layer) (cm)} \end{aligned}$$

The scavenging coefficient, Φ (in sec^{-1}), is calculated in CAP88-PC by multiplying the rainfall rate in cm/yr , by $1.0 \times 10^{-07} \text{ yr/cm-sec}$.

1 C.2.1.5 Plume Depletion

2
3 Radionuclides are depleted from the plume by precipitation scavenging, dry deposition, and radioactive
4 decay. Depletion is accounted for by substituting a reduced release rate, Q^1 , for the original release rate
5 Q for each downwind distance x (Slade, 1968). The ratio of the reduced release rate to the original is the
6 depletion fraction. The overall depletion fraction used in CAP88-PC is the product of the depletion
7 fractions for precipitation scavenging, dry deposition and radioactive decay.

8
9 For precipitation scavenging the depletion fraction for each downwind distance (x) is:

$$11 \quad \frac{Q^1}{Q} = e^{-\Phi t} \quad (Eq. 18)$$

13
14 where:

15 Φ = scavenging coefficient (sec^{-1})

16 t = time (sec) required for the plume to reach the downwind distance x

17
18 The depletion fraction for dry deposition is derived by using Equation (6) with z set to zero for ground-
19 level concentrations, and subtracting the quantity $(V_g x)/U$ from H for a tilted plume (Van, 1968, and
20 Moore, 1979):

$$22 \quad \frac{Q^1}{Q} = \exp \left\{ - \left(\frac{2}{\pi} \right)^{1/2} \left(\frac{V_d}{\mu} \right) \int_0^x \frac{\exp \left[- \left(\frac{H - V_g x}{\mu} \right) / 2\sigma_z^2 \right]}{\sigma_z} dx \right\} \quad (Eq. 19)$$

23
24 where:

25 V_d = deposition velocity (m/sec)

26 μ = wind speed (m/sec)

27 σ_z = vertical dispersion coefficient (m)

28 V_g = gravitational velocity (m/sec)

29 H = effective stack height (m)

30 x = downwind distance (m)

31
32 The integral expression must be evaluated numerically. Values for the vertical dispersion coefficient σ_z
33 are expressed as functions of x in the form $x^{D/F}$ where D and F are constants with different values for
34 each Pasquill atmospheric stability category, to facilitate integrations over x .

35
36 Values for the depletion fraction for cases where V_g is zero are obtained from the subroutine QY in CAP-
37 88. Subroutine QY obtains depletion fractions for the conditions $V_d = 0.01$ m/sec and $\mu = 1$ m/sec for
38 each Pasquill stability category from the data file REFA.DAT. This file contains values for release
39 heights (meters) of:

40
41 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12.5, 15, 17.5, 20, 25, 30, 35, 40, 50, 60, 70, 80, 90, 100, 120, 140, 160,
42 180, 200, 240, 260, 300 and 400;

and for downwind distances (meters) of:

35, 65, 100, 150, 200, 300, 400, 500, 650, 800, 1,000, 1,500, 2,000, 4,000, 7,000, 10,000, 25,000, 60,000, 90,000, and 200,000.

The stored depletion fractions were calculated numerically with a Simpson's rule routine. CAP88-PC uses a linear interpolation to produce a fraction for the required downwind value, release height and Pasquill category for $V_d = 0.01$ m/sec and $\mu = 1$ m/sec. The value is then converted to the appropriate value for the actual deposition velocity and wind speed by use of the equation:

$$(Q^1/Q)_2 = (Q^1/Q)_1^{100 V_d/\mu} \quad (\text{Eq. 20})$$

in which subscript 2 refers to the desired value and subscript 1 refers to the value for $V_d = 0.01$ m/sec and $\mu = 1$ m/sec.

For downwind distances greater than $2x_L$ where Equation 15 applies to the ground-level concentrations in air, the depletion is modeled with (Moore, 1979):

$$\frac{Q_x^1}{Q_{2x_L}^1} = \exp \left[-V_d (x - 2x_L) / L\mu \right] \quad (\text{Eq. 21})$$

Which shows the reduced release rates at distances x and $2x_L$, respectively.

The depletion fraction for radioactive decay is:

$$\frac{Q^1}{Q} = \exp(-\lambda_r t) \quad (\text{Eq. 22})$$

where:

λ_r = effective decay constant in plume

t = time required for plume travel

The decay constant used is referred to as the "effective decay constant" since it is not the true radiological decay constant in all cases. For example, if a radionuclide is a short-lived decay product in equilibrium with a longer-lived parent, the effective decay constant would be equal to the true radiological decay constant of the parent.

The atmospheric dispersion equations use the reciprocal-averaged wind speed, but neither this value nor the true average wind speed can adequately be used to calculate reduced release rates to account for radiological decay and scavenging losses because averaging of exponential terms is required. CAP88-PC uses an approximate method of calculation for this purpose, which establishes three wind speeds (1 m/sec, the average wind speed, and 6 m/sec) to simulate the actual wind-speed spectrum for each specific wind direction and Pasquill category. The wind speeds 1 and 6 m/sec were chosen because they approximate the upper and lower bounds in most meteorological data sets.

If f_1 , f_2 and f_3 are designated as the time fractions for the three wind speeds, then:

$$f_1 + (\mu_a f_2) + 6f_3 = \mu$$

$$f_1 + (f_2/\mu_a) + f_3/6 = 1/\mu_r$$

and

$$f_1 + f_2 + f_3 = 1$$

where:

μ_a = Arithmetic-average wind speed

μ_r = Reciprocal-average wind speed

Solving the three simultaneous equations yields:

$$f_1 = 1 - f_2 - f_3$$

$$f_2 = \frac{(7/6) - (\mu_a/6) - (1/\mu_r)}{(7/6) - (\mu_a/6) - (1/\mu_a)}$$

$$f_3 = \frac{(\mu_a - 1)(1 - f_2)}{5}$$

The depletion fraction to account for radioactive decay is then approximated by:

$$f_1 \exp(-\lambda_r x) + f_2 \exp[-\lambda_r(x/\mu_a)] + f_3 \exp[-\lambda_r(x/6)]$$

where:

λ_r = effective decay constant in plume (sec^{-1})

μ_a = Arithmetic-average wind speed

x = downwind distance (m)

For precipitation scavenging losses, the depletion fraction is:

$$f_1 \exp(-\Phi x) + f_2 \exp[-\Phi(x/\mu_a)] + f_3 \exp[-\Phi(x/6)]$$

where Φ is the scavenging coefficient (sec^{-1}).

The overall depletion fraction is calculated by multiplying the depletion fraction for dry deposition by the fraction for radioactive decay and precipitation scavenging.

C.2.1.6 Dispersion Coefficients

Horizontal and vertical dispersion coefficients (s_y and s_z) used for dispersion calculation in CONCEN and for depletion fraction determination in QY are taken from recommendations by G.A. Briggs of the Atmospheric Turbulence and Diffusion Laboratory at Oak Ridge, Tennessee (Moore, 1979, and Gifford, 1976). The coefficients are different functions of the downwind distance x for each Pasquill stability category for open-country conditions, as shown in Table C-6:

Table C-6 Coefficients for Open-Country Conditions

Pasquill category	σ_y (m)	σ_z (m)
A	$0.22 \times (1+0.0001x)^{-1/2}$	$0.20 \times x$
B	$0.16 \times (1+0.0001x)^{-1/2}$	$0.12 \times x$
C	$0.11 \times (1+0.0001x)^{-1/2}$	$0.08 \times (1+0.0002x)^{-1/2}$
D	$0.08 \times (1+0.0001x)^{-1/2}$	$0.06 \times (1+0.0015x)^{-1/2}$
E	$0.06 \times (1+0.0001x)^{-1/2}$	$0.03 \times (1+0.0003x)^{-1}$
F	$0.04 \times (1+0.0001x)^{-1/2}$	$0.016 \times (1+0.0003x)^{-1}$
G	calculated by subtracting half the difference between values for categories E and F from the value for category F.	

where:

x = downwind distance

CAP88-PC uses the functions in the form of

$$\sigma_y = x^A / C$$

$$\sigma_z = x^D / F$$

to facilitate integrations over x . Values for A, C, D, and F for each stability category and downwind distance are stored in a data statement.

C.2.1.7 Ground Surface Concentrations

Ground surface and soil concentrations are calculated for those nuclides subject to deposition due to dry deposition and precipitation scavenging. The deposition accumulation time is defined by the user. This value corresponds to establishing a cutoff for the time following a release when any significant intake or external exposure associated with deposition on soil might take place.

Ingrowth from a parent radionuclide is calculated using the Bateman decay equations for all chains contained in the isotope database from Federal Guidance Report 13. Ingrowth is calculated for the entire chain based on the decay time input by the user. The default decay time is 100 years.

Radionuclide concentrations in meat, milk, and vegetables are calculated using elemental transfer factors from Report 123 of the National Council on Radiation Protection (NCRP, 1996). The concentration in soil for each isotope is multiplied by the appropriate elemental transfer factor to generate a concentration in each of the ingestion pathways media for that isotope in that sector. This information is then supplied to the dose and risk calculation models via an intermediate output file.

C.2.2 Dose and Risk Estimates

CAP88-PC uses a modified version of DARTAB (ORNL, 1981) and a database of dose and risk factors from Federal Guidance Report 13 (EPA, 1999) for estimating dose and risk. Relevant portions of these documents are reproduced here, as referenced.

Dose and risk conversion factors include the effective dose equivalent calculated with the weighting factors in International Commission on Radiation Protection Publication Number 72 (ICRP, 1996). Dose

and risk factors are provided for the pathways of ingestion and inhalation intake, ground level air immersion, and ground surface irradiation. Factors are further broken down by particle size, clearance category chemical form, and gut-to-blood transfer factors. These factors are stored in a database for use by the program. At this time CAP88-PC only uses dose and risk factors for adult populations, for particle sizes of 1 micron, and for cancer mortality.

For assessments where radon-222 decay products are not considered, estimates of dose and risk are made by combining the inhalation and ingestion intake rates, air and ground surface concentrations with the appropriate dose and risk conversion factors. CAP88-PC lists the dose and risk to the maximum individual and the collective population. CAP88-PC calculates dose to the 23 internal organs in International Commission on Radiation Protection Publication 72 (ICRP, 1996) in addition to the 50 year effective dose equivalent. Risks are estimated for 15 cancer sites, including leukemia, bone, thyroid, breast, lung, stomach, colon, liver, pancreas, ovaries, skin, kidneys, esophagus, and bladder. Doses and risks can be further tabulated as a function of radionuclide, pathway, location, and organ.

For each assessment, CAP88-PC tabulates the frequency distribution of risk, that is, the number of people at various levels of risk (lifetime risk). The risk categories are divided into powers of ten, from one in ten to one in one million. The number of health effects is also tabulated for each risk category.

C.2.2.1 Air Immersion

Individual dose is calculated for air immersion with the general equation:

$$\frac{E_{ij}(k) DF_{ijl}}{P(k)} K_j$$

where:

$$\begin{aligned} E_{ij}(k) &= \text{exposure rate, person-pCi/cm}^3 \\ DF_{ijl} &= \text{Dose rate factor, mrem/nCi-yr/m}^3 \\ P(k) &= \text{number of exposed people} \\ K_j &= 0.001 \text{ nCi/pCi} \times 1,000,000 \text{ cm}^3/\text{m}^3 \text{ (proportionality factor)} \end{aligned}$$

Risk is calculated similarly, by substituting the risk conversion factor, for the dose conversion factor. The risk conversion factor is in units of risk/nCi-yr/m³.

C.2.2.2 Surface Exposure

Individual dose is calculated for ground surface exposure with the general equation:

$$\frac{E_{ij}(k) DF_{ijl}}{P(k)} K_j$$

where:

$$\begin{aligned} E_{ij}(k) &= \text{exposure rate, person-pCi/cm}^2 \\ DF_{ijl} &= \text{Dose rate factor, mrem/nCi-yr/m}^2 \\ P(k) &= \text{number of exposed people} \\ K_j &= 0.001 \text{ nCi/pCi} \times 10,000 \text{ cm}^2/\text{m}^2 \text{ (proportionality factor)} \end{aligned}$$

Risk is calculated by substituting the risk conversion factor for the dose conversion factor. The risk conversion factor is in units of risk/nCi-yr/m².

C.2.2.3 Ingestion and Inhalation

Individual dose is calculated for the ingestion and inhalation exposure pathway with the general equation:

$$\frac{E_{ij}(k)}{P(k)} DF_{ijl} K_j$$

where:

$E_{ij}(k)$	=	exposure rate, person-pCi/cm ³
DF_{ijl}	=	Dose rate factor, mrem/nCi-yr/m ³
$P(k)$	=	number of exposed people
K_j	=	0.001 nCi/pCi x 1,000,000 cm ³ /m ³ (proportionality factor)

Risk is calculated by substituting the risk conversion factor or the dose conversion factor.

C.2.2.4 Maximally-Exposed Individual

Doses for the maximally-exposed individual in population runs are estimated by CAP88-PC for the location, or sector-segment in the radial assessment grid, of highest risk where at least one individual actually resides. The effective dose equivalent for the maximally-exposed individual is tabulated in mrem/yr for a 50 year exposure. The reported risk associated with the 50 year Total Effective Dose Equivalent based on the risk coefficients contained in Federal Guidance Report 13.

When performing assessments of individual dose in CAP88-PC, the code will calculate the maximum individual dose based on the result from the highest grid point input by the user for that individual case. Alternatively, the user may specify the grid location where CAP88-PC is to generate the maximum exposed individual. This is done using the ILOC and JLOC parameters on the individual assessment grid input screen.

C.2.2.5 Collective Population

Collective population dose and risk are found by summing, for all sector segments, the intake and exposure rates multiplied by the appropriate dose or risk conversion factors from Federal Guidance Report 13. Collective population dose is reported by person-Rem per year (not millirem), and collective risk is reported in deaths per year.

C.3 References

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APPENDIX D
TRANSPORTATION ANALYSIS METHODOLOGY, ASSUMPTIONS, AND IMPACTS

APPENDIX D
TRANSPORTATION ANALYSIS METHODOLOGY, ASSUMPTIONS, AND IMPACTS

D.1 Introduction

This appendix presents the methodology and assumptions used to evaluate the potential impacts from the transportation of radiological materials to and from the proposed American Centrifuge Plant (ACP) near Piketon, Ohio. Transportation of radiological materials would include shipments of feed materials to the ACP, shipments of product materials from the proposed ACP, shipments of radioactive waste from the proposed ACP during the operation of the facility, and the eventual shipment of depleted uranium to a disposal site after its conversion from uranium hexafluoride (UF_6) to triuranium octaoxide (U_3O_8), a chemical form more suitable for disposal.

D.2 Radioactive Materials Description

The feed material consists of natural UF_6 and is transported in Type 48Y or Type 48X cylinders. The product consists of enriched UF_6 and is transported in Type 30B cylinders. Specifications for these cylinders are given in Table D-1. Two other radioactive materials requiring transportation that result from the conversion of UF_6 are depleted U_3O_8 and calcium fluoride (CaF_2), contaminated with uranium. Assuming no change in isotopic concentration of the uranium isotopes, the U_3O_8 material would have the same isotopic ratios as the depleted UF_6 tails. The CaF_2 could have about 55 becquerels (1.5 picocuries) per gram of depleted uranium as a radioactive contaminate (DOE, 2004). Finally radioactive waste resulting from routine operations and the eventual decontamination and decommissioning (D&D) of the plant would be transported to a waste disposal site. Specifications for 55-gallon drums and B-25 boxes, used to transport radioactive waste are give in Table D-2.

Table D-1 Specifications for Type 30B, 48X, and 48Y Cylinders

Cylinder Specification	30B	48X	48Y
Nominal Diameter	76 cm	122 cm	122 cm
Nominal Length	206 cm	302 cm	380 cm
Wall Thickness	1.3 cm	1.6 cm	1.6 cm
Nominal Tare Weight	635 kg	2,000 kg	2,359 kg
Maximum Net Weight	2,300 kg	9,540 kg	12,500 kg
Nominal Gross Weight	2,900 kg	11,600 kg	14,800 kg
Minimum Volume	0.74 m ³	3.05 m ³	4.04 m ³
Basic Construction Material	Steel: ASTM-516	Steel: ASTM-516	Steel: ASTM-516
Service Pressure	1,380 kPa gage	1,380 kPa gage	1,380 kPa gage
Hydrostatic Test Pressure	2,760 kPa gage	2,760 kPa gage	2,760 kPa gage
Isotopic Content Limit (Max. with Moderation Control)	5.0 % U-235	4.5 % U-235 (5.0% in-plant use)	4.5 % U-235
Valve Used	2.54 cm valve	2.54 cm valve	2.54 cm valve

Notes:

cm = centimeter; m³ = cubic meter; kg = kilogram; kPa = kilopascal; psi = pounds per square inch; ASTM = American Society for Testing and Materials.

To convert cm to inches multiply by 0.394.

To convert m³ to ft³ multiply by 35.3.

To convert kg to lb multiply by 2.2.

To convert kPa to psi multiply by 0.144.

Source: USEC, 1995.

Table D-2 Specifications for 55-Gallon Drums and B-25 Boxes

Cylinder Specification	55-Gallon Drum	B-25 Box
Nominal Diameter	61 cm	122 cm × 183 cm
Nominal Length	89 cm	122 cm
Minimum Volume	259 L	2,720 L
Material of Construction	Steel	Steel

Notes:

cm = centimeter; L = liter

To convert cm to inches multiply by 0.394.

To convert L to ft³ multiply by 0.35.

Source: USEC, 2005.

Table D-3 provides the isotopic mass fractions used to calculate the activities of the individual radionuclides in the various shipping containers. The calculated activity of the uranium isotopes and their

most prevalent progeny are given in Table D-4. The activities of the various isotopes of protactinium and thorium are calculated assuming one year of decay. These progeny along with the uranium isotopes account for more than 99 percent of the total activity of the radioactive materials described in Section D.1. While other progeny are present in very small quantities, their contribution to the total risk is negligible.

Table D-3 Uranium Isotopic Mass Fractions

Radionuclide	Mass Fraction		
	Feed Material (%)	Product Materials (%)	Depleted Tails (%)
U-234	0.0054	0.047	0.00052
U-235	0.7	4.7	0.3
U-238	99.3	95.2	99.7

Table D-4 Activities of Uranium, Protactinium, and Thorium Radionuclides in Various Shipping Containers (becquerels)

Radionuclide	Feed Material			Product 30B Cylinder	Heels 30B Cylinder	Radioactive Waste ¹		Depleted Uranium Bulk Bag	Calcium Fluoride Bulk Bag
	48X Cylinder	48Y Cylinder	30B Cylinder			55-Gallon Drum	B-25		
Th-230	7.4×10^5	9.6×10^5	1.6×10^6	1.6×10^6	8.1×10^3	0	0	1.1×10^5	5.2×10^{-1}
Th-231	3.7×10^9	4.8×10^9	5.9×10^9	5.9×10^9	2.9×10^7	7.4×10^6	7.4×10^7	2.1×10^9	1.0×10^4
Th-234	8.1×10^{10}	1.0×10^{11}	1.9×10^{10}	1.9×10^{10}	9.3×10^7	1.2×10^8	1.6×10^9	1.2×10^{11}	5.6×10^5
Pa-231	7.8×10^4	1.0×10^5	1.2×10^5	1.2×10^5	5.9×10^2	0	0	4.4×10^4	2.1×10^{-1}
Pa-234	1.0×10^8	1.4×10^8	2.4×10^7	2.4×10^7	1.2×10^5	0	0	1.6×10^8	7.4×10^2
Pa-234m	8.1×10^{10}	1.0×10^{11}	1.9×10^{10}	1.9×10^{10}	9.3×10^7	1.2×10^8	1.6×10^9	1.2×10^{11}	5.6×10^4
U-234	8.1×10^{10}	1.0×10^{11}	1.7×10^{11}	1.7×10^{11}	8.1×10^8	1.2×10^8	1.6×10^9	1.1×10^{10}	5.6×10^4
U-235	3.7×10^9	4.8×10^9	1.6×10^9	1.6×10^9	2.9×10^7	7.4×10^6	7.4×10^7	2.1×10^9	1.0×10^4
U-238	8.1×10^{10}	1.0×10^{11}	1.9×10^{10}	1.9×10^{10}	9.3×10^7	1.2×10^8	1.6×10^9	1.2×10^{11}	5.6×10^5
Total Curies	3.3×10^{11}	4.1×10^{11}	2.4×10^{11}	2.4×10^{11}	1.0×10^9	5.2×10^8	6.7×10^9	3.7×10^{11}	1.7×10^6

Notes:

1 curie (Ci) = 3.7×10^{10} becquerels

¹Source: USEC, 2005.

D.3 Transportation Routes

Transportation of radiological materials would include shipments of feed material (natural UF_6) to the proposed ACP, shipments of product materials (enriched UF_6) from the proposed ACP, and shipments of radioactive waste from the proposed ACP (USEC, 2005). Depleted UF_6 is assumed to be stored onsite until it is converted from UF_6 to U_3O_8 , a more stable chemical form, and then transported by railcar to a low-level radioactive waste disposal site. According to the ACP Environmental Report, feed materials will be transported from Metropolis, Illinois; Port Hope, Ontario, Canada; and Wilmington, Delaware in Type 48Y, Type 48X, and Type 30B cylinders, respectively. Product materials will be shipped to Richland, Washington; Columbia, South Carolina; Wilmington, North Carolina; and Seattle, Washington in Type 30B cylinders. Wilmington, Delaware is the shipping port for feed materials from Russia, while Seattle is the port for product shipments to Korea, and Japan. Low-level radioactive waste (LLRW) will be shipped to Gainesville, Florida; Clive, Utah; and the Nevada Test Site. The transportation of radiological materials is subject to NRC and DOT regulations. Table D-5 presents a matrix of the shipping origins and destinations for the various radioactive materials.

In addition to the transport of radioactive materials during the operation of the proposed ACP, low-level radioactive waste will be shipped to disposal sites during decontamination and decommissioning (D&D) waste are expected to include of the proposed ACP. Shipments of decontamination and decommissioning waste are expected to be 5,100 shipments to the Nevada Test Site; 105 shipments to Clive, Utah; and 60 shipments to Kingston, Ohio.

WebTragis (ORNL, 2003) was used to generate the routing information. WebTragis is a web-based version of Tragis (Transport Routing Analysis Geographic Information System) and is used to calculate highway, rail, or waterway routes within the United States. WebTragis generates routing distance, population density within 800 meters (0.5 mile), and for the truck routes, the number of rest stops and stops for State inspections. Table D-6 presents the output from WebTragis to be used in this risk assessment. For Port Hope, Ontario, an additional 241 kilometers (150 miles) of route distance was added to the TRAGIS output to account for that portion of the route located in Canada. Even though transportation regulations by truck do not require restricted routing for the shipment of natural uranium, low-enriched uranium, or depleted uranium, routing restrictions were applied as follows (USEC, 2005):

- Highway Route Controlled Quantity preferred route with two drivers;
- Prohibit use of links prohibiting truck use; and
- Prohibit use of ferry crossing; prohibit use of roads with hazardous materials prohibition.

Table D-5 Radioactive Waste Shipment Routes

Route	Radioactive Shipments							
	Feed Material (Natural UF ₆)	Product (Enriched UF ₆)	Heeled Containers	LowLevel Radioactive Waste	Mixed Low- Level Radioactive Waste	Low-Level Liquid Radioactive Waste	Depleted Uranium (U ₃ O ₈)	Calcium Fluoride (CaF ₂)
Metropolis, IL to ACP	✓							
Port Huron, ON to ACP	✓							
Wilmington, DE to ACP	✓							
ACP to Richland, WA		✓	✓					
ACP to Columbia, SC		✓	✓					
ACP to Wilmington, NC		✓						
ACP to Seattle, WA		✓						
ACP to Clive, UT				✓			✓	✓
ACP to Nevada Test Site, NV				✓				
ACP to Gainesville, FL					✓			
ACP to Oak Ridge, TN						✓		

Source: USEC, 2005.

Table D-6 Route Information as Generated by TRAGIS

Destination/ Origin	Distance (km)				Elapsed Time (hh:mm)	Weighted Population (people/km ²)			Population within 800 m Buffer Zone
	Rural	Suburban	Urban	Total		Rural	Suburban	Urban	
Metropolis, IL	554.1 (63.0%)	307.3 (35.0%)	17.7 (2.0%)	879.1 (100%)	9:31	20.6	282	2,193	174,192
Port Hope, ON	457.8 (50.9%)	392.7 (43.7%)	48.2 (5.4%)	898.7 (100%)	10:26	21	305.2	2,444	316,151
Wilmington, DE	474.4 (54.3%)	355.3 (40.7%)	44.3 (5.1%)	873.9 (100%)	10:06	19	330.6	2,316	308,509
Richland, WA	3,130.9 (81.4%)	653.4 (17.0%)	60.8 (1.6%)	3,844.8 (100%)	41:27	10.9	298.3	2,235	494,741
Columbia, SC	422.2 (53.8%)	331.8 (42.3%)	30.4 (3.9%)	784.3 (100%)	8:02	17.6	367	2,278	256,008
Wilmington, NC	549.2 (55.3%)	409.7 (41.3%)	33.8 (3.4%)	992.6 (100%)	10:26	18.3	359.1	2,150	305,803
Seattle, WA	3,229.9 (79.2%)	743.8 (18.2%)	103.6 (2.5%)	4,077.2 (100%)	44:09	11	320.7	2,319	695,631
Clive, UT	2,430.1 (80.7%)	520.8 (17.3%)	60.1 (2.0%)	3,010.9 (100%)	31:46	11.1	310.4	2,292	448,863
Nevada Test Site, NV	2,935.2 (80.6%)	617.7 (17.0%)	90.5 (2.5%)	3,643.1 (100%)	38:15	10.7	316.2	2,405	614,875
Gainesville, FL	875.3 (61.2%)	519.4 (36.3%)	36.3 (2.5%)	1,430.8 (100%)	14:52	15.1	334.6	2,306	343,734
Oak Ridge, TN	350.9 (59.1%)	226.6 (38.2%)	16.3 (2.8%)	593.3 (100%)	6:20	21	293.8	2,065	131,400

Notes:

km = kilometer; km² = square kilometer

To convert km to mi multiply by 0.62.

To convert from km² to mi² multiply by 0.386.

D.4 RADTRAN Modeling Inputs and Results

The radiological impacts to occupational workers and the general public from the transport of the radioactive materials were estimated using RADTRAN 5 (Osborn, 2005), a computer code that calculates the risks for both the incident-free transport of radioactive-material and for accidents. The term “incident free” means that no traffic accident or other incident resulted in the release of radioactive material to the surrounding environment. In this context, accidents refer only to incidents that result in the release of radioactive material. The risks associated with the transport of radioactive materials include injuries and fatalities from traffic accidents and an increased risk of cancer fatalities from exposure of persons near the vehicle to direct radiation.

Exposure to radiation from radioactive shipments is assumed to result in an increased risk of latent cancer to crews operating the truck or train, persons sharing the route with the shipment (on-link public), persons living alongside the route (off-link public), and persons at rest stops and inspection stops. These latent cancers do not occur immediately after exposure, but instead occur a number of years after the exposure. RADTRAN 5 estimates the number of latent cancer fatalities from the incident free transport of the materials and accidents.

D.4.1 Incident-Free Parameters

The risks from incident-free transport depend on the external radiation levels of the package being transported; the length and time duration of the route; and the number of persons sharing the route. Tables D-7 and D-8 provide a listing of the input parameters to RADTRAN that were used in this risk assessment.

Table D-7 RADTRAN “Package” Parameters

Package	RADTRAN Parameter			
	Long Dimension (m)	Dose Rate (mrem/hr) ¹	Gamma Fraction	Neutron Fraction
Feed Material (48X cylinder)	3.0	0.7	1	0
Feed Material (48Y cylinder)	3.8	0.7	1	0
Feed Material (30B cylinder)	2.1	0.7	1	0
Product Material (30B cylinder)	2.1	0.4	1	0
Heels (30B cylinder)	2.1	0.4	1	0
Waste (55-gallon drums)	0.9	1	1	0
Waste (B-25)	1.8	1	1	0
Depleted UF ₆ (bulk bag)	8	1	1	0
CaF ₂ (bulk bag)	8	0.0001	1	0

Notes:

¹Dose rate is the external dose rate at 1 m from the package.

m = meter; mrem/hr = millirem per hour

To convert from m to ft multiply by 3.28.

Table D-8 RADTRAN “Link” Parameters

RADTRAN Parameter	Link		
	Rural	Suburban	Urban
Speed (km/hr)	88.5	40.2	24.1
Vehicle Density (vehicles/hr)	470	780	2,800
Persons Per Vehicle	2	2	2
Accident Rate (accidents/vehicle-hour)	3×10^{-7}	3×10^{-7}	3×10^{-7}
Zone	Rural	Suburban	Urban
Type	Primary Highway	Primary Highway	Primary Highway
Farm Fraction	1	0	0

Notes:

km = kilometer

To convert km to mi multiply by 0.62.

D.4.2 Accident Parameters

To calculate the risk associated with accidents that result in the release of radioactive material, RADTRAN 5 estimates the probability, or likelihood, of an accident and the consequences, or outcome, of such an accident. The likelihood or frequency of an accident is a function of the type of road and the number of vehicles using the road. NRC classifies accidents into eight severity categories, based on the mechanical (impact) and thermal (fire) forces involved (NRC, 1977). Category I is the least severe and Category VIII is the most severe. Less severe accidents occur more frequently, but have relatively mild consequences. More severe accidents happen less frequently, but have more significant consequences, including the release of some or all of the radioactive material in the shipment. NRC has estimated the fraction of accidents for truck and rail transport that fall within each category. Additionally, NRC has estimated the fraction of accidents in each category that occur in rural, suburban, and urban areas. As shown in Table 2-9 less severe accidents are most likely to occur in urban areas, where driving speeds are typically lower, while more severe accidents are more likely to occur in rural areas where driving speeds are higher (NRC, 1977). These estimates when combined with average accident rates are used estimate the number of latent cancer fatalities due to exposure to radiation and radioactivity from transportation accidents. Fatalities to chemical effects and bodily injury are addressed separately. Tables D-9 and D-10 provided the fractional occurrences of accidents by severity category used in this risk assessment.

Table D-9 Fractional Occurrences of Truck Accidents by Severity Category

Accident Severity Category	Fractional Occurrences of Severity Category	Fractional Occurrence by Population Zone		
		Rural	Suburban	Urban
I	0.55	0.1	0.1	0.8
II	0.36	0.1	0.1	0.8
III	0.07	0.3	0.4	0.3
IV	0.016	0.3	0.4	0.3
V	0.0028	0.5	0.3	0.2
VI	0.0011	0.7	0.2	0.1
VII	0.000085	0.8	0.1	0.1
VIII	0.000015	0.9	0.05	0.05

Source: NRC, 1977.

Table D-10 Fractional Occurrences of Rail Accidents by Severity Category

Accident Severity Category	Fractional Occurrences of Severity Category	Fractional Occurrence by Population Zone		
		Rural	Suburban	Urban
I	0.5	0.1	0.1	0.8
II	0.3	0.1	0.1	0.8
III	0.18	0.3	0.4	0.3
IV	0.018	0.3	0.4	0.3
V	0.0018	0.5	0.3	0.2
VI	0.00013	0.7	0.2	0.1
VII	0.00006	0.8	0.1	0.1
VIII	0.00001	0.9	0.05	0.05

Source: NRC, 1977.

Table D-11 provides the release fraction used for each severity category. For purposes of this analysis, all releases of material are assumed to be airborne and respirable.

Table D-11 Release Fractions for Accidents by Severity Category

Accident Severity Category	Release Fraction
I	0
II	0.01
III	0.1
IV, V, VI, VII, and VIII	1

Source: DOE, 2002.

D.4.3 RADTRAN Results

The transportation of feed material, product, heel cylinders, radioactive waste, and the products from the conversion of depleted UF_6 results in some increased risk of cancer to both the occupational workers transporting and handling the material and to members of the public driving on the roads or living along the transportation route. RADTRAN results for the transportation of radioactive materials associated with operations are given in Tables D-12 and D-13 on an annual basis. The transport of all materials is estimated to result in approximately 0.014 latent cancer fatalities per year of operation due to direct radiation exposure during incident-free transport, and an additional 0.008 latent cancer fatalities per year from accidents that result in the release of radioactive material into the environment. The total latent cancer fatalities per year is estimated to be 0.02 per year of operation or about one cancer fatality over thirty years of operation.

In addition to the transport of radioactive materials during the operation of the proposed ACP, low level radioactive waste will be shipped to disposal sites during decontamination and decommissioning (D&D) of the proposed ACP. Tables D-14 and D-15 provide the RADTRAN results for the transportation of radioactive materials associated with all decontamination and decommissioning activities of the proposed ACP. The number of latent cancer fatalities from the transportation of all decontamination and decommissioning waste is estimated to be 0.3, including 0.005 deaths resulting from the release of radioactive material from accidents.

The risk assessment described above is for product materials enriched to approximately 5 percent weight percent of uranium-235. Although it is currently believed to be unlikely, USEC may in the future enrich relatively small volumes of product up to 10 weight percent of uranium-235. There are currently no 2.5 ton cylinders certified for the shipment of UF_6 . In the event this higher enrichment occurs, USEC would have to gain the appropriate certification before it shipped 10 percent product in either an existing 2.5-ton cylinder or in a new 2.5-ton cylinder. External exposure rates surrounding such a cylinder would likely be similar to those around the 30B cylinders presently used to ship 5 percent product and less than the external dose equivalent rates used in this assessment, which are considered conservative. For this reason, the risks associated with the incident free transport of the 10 percent enriched product would not be significantly than that of the 5 percent enriched product.

Table D-12 Number of Latent Cancer Fatalities Expected from the Incident-Free Transportation of Radioactive Materials for One Year of Operation

Route	Material	Latent Cancer Fatalities							
		MEI	Drivers	Off-Link Public	On-Link Public	Rest Stop	Inspection Stop	Loading	Total
Metropolis, IL to ACP	Feed Material	6.2×10^{-9}	1.2×10^{-3}	6.8×10^{-5}	4.4×10^{-4}	8.1×10^{-4}	1.1×10^{-3}	3.0×10^{-3}	4.0×10^{-3}
Port Hope, ON to ACP	Feed Material	9.4×10^{-9}	1.4×10^{-3}	1.4×10^{-4}	1.1×10^{-3}	1.2×10^{-3}	6.9×10^{-4}	5.2×10^{-4}	5.1×10^{-3}
Wilmington, DE to ACP	Feed Material	1.5×10^{-9}	2.5×10^{-4}	2.2×10^{-5}	1.7×10^{-4}	2.0×10^{-4}	1.8×10^{-4}	9.7×10^{-5}	9.1×10^{-4}
ACP to Richland, WA	Product	5.0×10^{-10}	2.8×10^{-4}	1.3×10^{-5}	1.1×10^{-4}	2.6×10^{-4}	1.1×10^{-4}	6.5×10^{-5}	8.3×10^{-4}
ACP to Columbia, SC	Product	5.9×10^{-10}	8.8×10^{-5}	8.8×10^{-6}	5.2×10^{-5}	3.8×10^{-5}	7.1×10^{-5}	7.7×10^{-5}	3.3×10^{-4}
ACP to Wilmington, NC	Product	6.7×10^{-10}	1.2×10^{-4}	1.2×10^{-5}	7.0×10^{-5}	8.7×10^{-5}	6.4×10^{-5}	8.7×10^{-5}	4.4×10^{-4}
ACP to Seattle, WA (Korea)	Product	1.3×10^{-10}	1.1×10^{-4}	4.0×10^{-6}	3.6×10^{-5}	8.3×10^{-5}	3.3×10^{-5}	1.6×10^{-5}	2.8×10^{-4}
ACP to Seattle, WA (Japan)	Product	1.9×10^{-10}	1.5×10^{-4}	7.7×10^{-6}	7.0×10^{-5}	2.3×10^{-4}	5.4×10^{-5}	2.2×10^{-5}	5.4×10^{-4}
Richland, WA to ACP	Heels	8.9×10^{-11}	5.1×10^{-5}	2.3×10^{-6}	1.9×10^{-5}	4.7×10^{-5}	1.9×10^{-5}	4.9×10^{-5}	1.9×10^{-4}
Columbia, SC to ACP	Heels	8.9×10^{-11}	1.3×10^{-5}	1.3×10^{-6}	8.0×10^{-6}	5.8×10^{-6}	1.1×10^{-5}	4.9×10^{-5}	8.8×10^{-5}
ACP to Clive UT	LLW	3.5×10^{-10}	1.3×10^{-4}	7.4×10^{-6}	6.4×10^{-5}	1.6×10^{-4}	4.1×10^{-5}	7.3×10^{-5}	4.7×10^{-4}
ACP to Nevada Test Site, NV	LLW	1.4×10^{-10}	1.6×10^{-4}	3.6×10^{-6}	3.4×10^{-5}	8.1×10^{-5}	3.8×10^{-5}	3.0×10^{-5}	3.5×10^{-4}
ACP to Gainesville, FL	Mixed LLW	7.3×10^{-11}	2.5×10^{-5}	1.6×10^{-6}	9.3×10^{-6}	1.4×10^{-5}	1.4×10^{-5}	1.0×10^{-5}	7.5×10^{-5}
Piketon, OH to Clive, UT	U ₃ O ₈	3.2×10^{-11}	2.2×10^{-7}	7.3×10^{-7}	7.3×10^{-8}	2.7×10^{-5}	0	0	2.8×10^{-5}
Piketon, OH to Clive, UT	CaF ₂	3.2×10^{-15}	2.2×10^{-10}	7.3×10^{-11}	7.3×10^{-11}	2.7×10^{-9}	0	0	3.1×10^{-9}
Total		9.4×10^{-9}	4.0×10^{-3}	2.9×10^{-4}	2.2×10^{-3}	3.3×10^{-3}	2.4×10^{-3}	1.4×10^{-3}	1.4×10^{-2}

**Table D-13 Number of Latent Cancer Fatalities Expected from Accidents Resulting from the
Transportation of Radioactive Materials for One Year of Operation**

Route	Material	Latent Cancer Fatalities				
		Ground	Inhaled	Resuspended	Cloudshine	Total
Metropolis, IL to ACP	Feed Material	5.2×10^{-6}	4.8×10^{-4}	3.2×10^{-4}	3.5×10^{-10}	8.0×10^{-4}
Port Hope, ON to ACP	Feed Material	1.3×10^{-5}	1.2×10^{-3}	8.0×10^{-4}	8.8×10^{-10}	2.0×10^{-3}
Wilmington, DE to ACP	Feed Material	9.8×10^{-6}	8.0×10^{-4}	5.2×10^{-4}	2.5×10^{-10}	1.3×10^{-3}
ACP to Richland, WA	Product	7.5×10^{-6}	6.6×10^{-4}	2.1×10^{-4}	2.0×10^{-10}	8.7×10^{-4}
ACP to Columbia, SC	Product	4.9×10^{-6}	4.3×10^{-4}	1.3×10^{-4}	1.3×10^{-10}	5.6×10^{-4}
ACP to Wilmington, NC	Product	6.5×10^{-6}	5.7×10^{-4}	1.8×10^{-4}	1.8×10^{-10}	7.5×10^{-4}
ACP to Seattle, WA (Korea)	Product	2.5×10^{-6}	2.1×10^{-4}	6.9×10^{-5}	6.6×10^{-11}	2.8×10^{-4}
ACP to Seattle, WA (Japan)	Product	3.5×10^{-6}	3.0×10^{-4}	9.6×10^{-5}	9.2×10^{-11}	3.9×10^{-4}
Richland, WA to ACP	Heels	5.2×10^{-8}	3.2×10^{-6}	7.2×10^{-6}	1.0×10^{-12}	1.0×10^{-5}
Columbia, SC to ACP	Heels	2.8×10^{-8}	1.8×10^{-6}	4.0×10^{-6}	5.5×10^{-13}	5.8×10^{-6}
ACP to Clive UT	LLW	5.2×10^{-8}	4.4×10^{-6}	5.1×10^{-6}	5.7×10^{-12}	9.5×10^{-6}
ACP to Nevada Test Site, NV	LLW	8.8×10^{-9}	5.5×10^{-7}	1.7×10^{-6}	4.5×10^{-12}	2.2×10^{-6}
ACP to Gainesville, FL	Mixed LLW	2.0×10^{-9}	1.3×10^{-7}	5.7×10^{-7}	1.0×10^{-12}	7.0×10^{-7}
Piketon, OH to Clive, UT	U ₃ O ₈	1.7×10^{-6}	7.4×10^{-4}	6.1×10^{-7}	9.1×10^{-10}	7.5×10^{-4}
Piketon, OH to Clive, UT	CaF ₂	3.5×10^{-11}	2.9×10^{-9}	1.3×10^{-8}	3.6×10^{-15}	1.6×10^{-8}
Total		5.4×10^{-5}	5.4×10^{-3}	2.3×10^{-3}	3.1×10^{-9}	7.8×10^{-3}

Table D-14 Number of Latent Cancer Fatalities Expected from the Incident-Free Transportation of Radioactive Materials of All Decontamination and Decommissioning (D&D) Waste

Route	Material	Latent Cancer Fatalities							
		MEI	Drivers	Off-Link Public	On-Link Public	Rest Stop	Inspection Stop	Loading	Total
ACP to Clive, UT	D&D Waste	4.1×10^{-9}	1.4×10^{-3}	8.6×10^{-5}	7.4×10^{-4}	2.2×10^{-3}	1.9×10^{-3}	4.7×10^{-4}	6.8×10^{-3}
ACP to Nevada Test Site, NV	D&D Waste	2.0×10^{-7}	8.9×10^{-2}	5.1×10^{-3}	4.8×10^{-2}	1.2×10^{-1}	3.1×10^{-2}	2.1×10^{-2}	3.1×10^{-1}
ACP to Kingston, TN	D&D Waste	1.8×10^{-10}	2.7×10^{-5}	1.5×10^{-6}	1.0×10^{-5}	1.2×10^{-5}	1.0×10^{-5}	1.1×10^{-4}	1.7×10^{-4}
Total		2.0×10^{-7}	9.1×10^{-2}	5.2×10^{-3}	4.9×10^{-2}	1.2×10^{-1}	3.2×10^{-2}	2.1×10^{-2}	3.2×10^{-1}

Table D-15 Number of Latent Cancer Fatalities Expected from Accidents Resulting from the Transportation of Radioactive Materials of All Decontamination and Decommissioning (D&D) Waste

Route	Material	Latent Cancer Fatalities				
		Ground	Inhaled	Resuspended	Cloudshine	Total
ACP to Clive, UT	D&D Waste	3.2×10^{-7}	2.5×10^{-5}	4.7×10^{-5}	3.3×10^{-11}	7.3×10^{-5}
ACP to Nevada Test Site, NV	D&D Waste	2.1×10^{-5}	1.6×10^{-3}	3.0×10^{-3}	2.1×10^{-9}	4.7×10^{-3}
ACP to Kingston, TN	D&D Waste	7.5×10^{-9}	5.3×10^{-7}	1.2×10^{-6}	4.4×10^{-12}	1.7×10^{-6}
Total		2.1×10^{-5}	1.7×10^{-3}	3.1×10^{-3}	2.1×10^{-9}	4.7×10^{-3}

1 However, the accident related radiological risks associated with the transport of the 10 percent enriched
2 product would be somewhat greater than that of the 5 percent enriched product. This primarily due to the
3 higher activity of uranium-234 in the 10 percent enriched product. Uranium-234 does not contribute
4 significantly to the external dose rate, but is an inhalation hazard if released. Table D-16 shows the
5 calculated latent cancer fatalities from the transport of the higher enriched product material for the same
6 routes used previously. The number of expected latent cancer fatalities associated with the transport of
7 product material only would be approximately a factor of three greater than that previously estimated. It
8 should be noted that this factor of three is conservative in that it assumes all the product material is
9 enriched to 10 percent; and that it does not account for the decreased risks associated with lower activities
10 of uranium-234 in shipment of the conversion products.

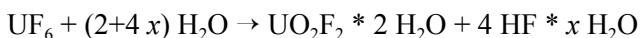
Table D-16 Number of Latent Cancer Fatalities Expected from Accidents Resulting from the Transportation of Product Material Enriched to 10 Percent for One Year of Operation

Route	Material	Latent Cancer Fatalities				
		Ground	Inhaled	Resuspended	Cloudshine	Total
ACP to Richland, WA	Product	1.6×10^{-5}	2.3×10^{-3}	1.4×10^{-4}	3.6×10^{-10}	2.5×10^{-3}
ACP to Columbia, SC	Product	1.0×10^{-5}	1.5×10^{-3}	9.4×10^{-5}	2.4×10^{-10}	1.6×10^{-3}
ACP to Wilmington, NC	Product	1.3×10^{-5}	2.0×10^{-3}	1.3×10^{-4}	3.1×10^{-10}	2.1×10^{-3}
ACP to Seattle, WA (Korea)	Product	5.2×10^{-6}	7.5×10^{-4}	1.1×10^{-4}	1.2×10^{-10}	8.6×10^{-4}
ACP to Seattle, WA (Japan)	Product	7.3×10^{-6}	1.0×10^{-3}	1.5×10^{-4}	1.6×10^{-10}	1.2×10^{-3}
Total		5.2×10^{-5}	7.6×10^{-3}	6.2×10^{-4}	1.2×10^{-9}	8.3×10^{-3}

D.5 Chemical Impacts from Transportation Accidents

In addition to the radiological impacts during transportation described above, chemical impacts from a transportation accident involving uranium could also affect the surrounding public. Uranium compounds, in addition to being radioactive, can have toxic chemical effects (primarily on the kidneys) if inhaled or ingested. The operation of the ACP would result in the transport of UF₆ as feed and product material to and from the ACP, as well as the transport of triuranium octaoxide as a conversion product. Calcium fluoride, another conversion product, contains small amounts of uranium as a contaminant.

Uranium hexafluoride does not react with nitrogen (N₂), oxygen (O₂), carbon dioxide (CO₂) or dry air, but does react rapidly with water vapor to hydrogen fluoride (HF) and uranyl fluoride (UO₂F₂):



Hydrogen fluoride is extremely corrosive and can damage the lungs and cause death if inhaled at high enough concentrations. Irreversible adverse effects resulting from sufficiently high concentrations of these chemicals include permanent organ damage or the impairment of everyday functions, and possibly death. The number of deaths resulting from the chemical effects of hydrogen fluoride and uranyl fluoride is estimated to occur in one percent of those experiencing irreversible effects (Policastro et al., 1997). In contrast to the irreversible adverse effects from exposure to higher concentrations of hydrogen fluoride and uranyl fluoride, the adverse effects from exposure to lower concentrations include skin rash and respiratory irritation.

To estimate the chemical effects of an accident involving the transport of UF₆, the Department of Energy (ANL 2001, DOE 2004) modeled the dispersion of chemical emissions released into the environment from a transportation accident involving a fire. The results were used to determine the number of people whose exposure would exceed the threshold for adverse and irreversible adverse effects. DOE estimated the chemical effects for accidents in rural, suburban, and urban areas. Table D-17 shows the potential chemical impacts to the public from a hypothetical severe transportation accident that involves a fire.

**Table D-17 Potential Chemical Consequences to the Population
from Severe Transportation Accidents**

Material	Mode	Number of Persons with Potential Adverse Health Effects			Number of Persons with Potential Irreversible Adverse Health Effects		
		Rural	Suburban	Urban	Rural	Suburban	Urban
UF ₆	Truck	6	760	1,700	0	1	3
U ₃ O ₈	Rail	0	47	103	0	17	38

Source: DOE, 2004.

Based on the total number of trips, the length of the trips, and the mean accident rate, the estimated number of accidents involving shipments of UF₆ is 0.5 accidents per year, or an average of one accident every two years. Of these accidents, approximately 55 percent will not result in the release of any UF₆, and another 43 percent will result in a release of no more than 10 percent of the UF₆. About 2 percent of all accidents are expected to be severe enough to result in the release of all the UF₆ present. The probability of one or more of the fifteen expected accidents being this severe is about 26 percent. Such an accident is most likely to occur in a rural or suburban area.

D.6 References

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- (NRC 1977) U.S. Nuclear Regulatory Commission. "Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes." NUREG-0170. 1977.
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- (USEC, 2005) United States Enrichment Corporation. "Environmental Report for the American Centrifuge Plant" LA-3605-0002. Revision 3. NRC Docket No. 70-7004. July 2005.

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APPENDIX E
AIR QUALITY ANALYSIS

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APPENDIX E
AIR QUALITY ANALYSIS

E.1 Air Dispersion Modeling Inputs

This section discusses the inputs used in the application of the ISCLT3 air dispersion model (EPA, 1995) to assess the non-radiological air quality impacts from site preparation and construction as well as from the operation of the proposed ACP. Modeling results can be found in Chapter 4 of the Draft EIS.

E.1.1 Emissions from Site Preparation and Construction

Emissions during the site preparation and construction phases can be divided into four parts: emissions from diesel equipment used by the work crews, emissions from gasoline-powered trucks used by the work crews, emissions from commuter vehicles and delivery trucks, and fugitive dust from construction activity for the construction of new buildings. Emissions related to work crews, crew trucks, and fugitive dust were modeled as area sources with the same footprint as the building being constructed or prepared. Emissions from on-road vehicles were modeled as elongated area sources following the most likely (shortest distance from main entrance) route of traffic.

During the construction period, four work crews are expected to be active: the steel crew, the electrical and mechanical crew, the equipment crew, and the utilities crew. Equipment and fuel proposed for use for each crew are summarized in Table E-1. (USEC, 2005) Diesel equipment is assumed to consume one gallon of fuel per 10 hp per day with equipment horsepowers were taken from the Means Open Shop Building Construction Cost Data Book (USEC, 2005). Each crew trucks is assumed to consume 10 gallons of gasoline per day.

Table E-1 Equipment and Fuel Use Associated with each Crew

Steel Crew			Electrical and Mechanical Crews		
90T Crane	275	hp	Bucket Truck	200	hp
Welding	50	hp	55T Crane	170	hp
Diesel	260	gal/day	12T Crane	40	hp
Gas	40	gal/day	Diesel	328	gal/day
			Gas	30	gal/day
Utilities Crew			Equipment Crew		
Excavator	240	hp	90T Crane	275	hp
Diesel	192	gal/day	Diesel	220	gal/day
Gas	10	gal/day	Gas	20	gal/day

Notes:

gal/day = gallons per day; hp = horsepower

The NONROAD model is the EPA's standard method for preparing emissions inventories for mobile sources that are not classified as being related to on-road traffic, railroads, air traffic, or water going vessels (EPA, 2002a). The model was developed to estimate county-level emission inventories, but contains all of the information needed to develop a facility specific inventory. Thus NRC used the supporting information from the NONROAD model for developing a site-specific emission inventory.

1 The NONROAD model uses the following general equation to estimate emissions separately for CO,
2 NO_x, PM (essentially all the PM from combustion is PM_{2.5}), and THC:

$$3 \quad \text{EMS} = \text{EF} * \text{HP} * \text{LF} * \text{ACT} * \text{DF} \quad (\text{Eq. 1})$$

5 where:

6 EMS = estimated emissions

7 EF = emissions factor in grams per horsepower hours

8 HP = peak horsepower

9 LF = load factor (assumed percentage of peak horsepower)

10 ACT = Activity in hours of operation per period of operation

11 DF = Deterioration Factor

12
13
14 The emissions factor (EF) is specific to the equipment type, engine size, and technology type. The
15 technology type for diesel equipment can be “Base” (before 1988), Tier 0 (1988-1999), or Tier 1 (2000-
16 2005). Tier 2 emissions factors are appropriate for equipment that satisfies 2006 national standards (or
17 slightly earlier California standards). The range in years represents a phase-in by equipment type, engine
18 size and technology. Since most construction activity is schedule for the 2007-2010 time period it was
19 assumed that equipment would meet the Tier 1 standard. Different emissions factors are applied to
20 different ranges of engine sizes. These size ranges are lower bound exclusive and upper bound inclusive.
21 Thus a 175 hp diesel forklift is included in the 100-175 hp range rather than the 175-300 hp range.

22
23 The load factor (LF) is specific to the equipment type in the NONROAD model regardless of engine size
24 or technology type and represents the average fraction of peak horsepower at which the engine is assumed
25 to operate.

26
27 The deterioration factor (DF) is used to estimate increased emissions due to engine age and is calculated
28 according to the following equation:

$$29 \quad \text{DF} = 1 + \text{A} * (\text{AGE})^b \quad (\text{Eq. 2})$$

30 where:

31 A, b = factors given specified in the NONROAD model

32 AGE = normalized age of the engine

33
34
35 The normalized age of each type of engine appearing in the NONROAD model is calculated using
36 equation 3:

$$37 \quad \text{AGE} = (\text{cumulative hours of operation}) * \text{LF} / (\text{median engine life}) \quad (\text{Eq. 3})$$

38
39
40 The median engine life is specified in the NONROAD model’s data files and LF is the load factor used in
41 equation 1 above. The “cumulative hours of operation” can be calculated by multiplying the age in years
42 of the engine by the average activity assumed by the NONROAD model. For this study we assumed a
43 nominal equipment age of five years.

44
45
46 The source classification code and name associated by the NONROAD model with each piece of
47 equipment is presented in Table E-2.

**Table E-2 Equipment with Source Classification Codes and Names
as they appear in the NONROAD Data Tables**

Equipment	Source Classification Code	NONROAD Name
Bucket Truck	2270003010	Diesel Aerial Lift
Crane	2270002045	Diesel Crane
Excavator	2270002036	Diesel Excavator
Welding	2270006025	Diesel Light Commercial Welder

All of the information needed to estimate the facility specific emissions is available as part of the NONROAD model's data files. Sample calculations for estimating CO emissions from the 240 hp excavator follow.

From the NONROAD model data file ACTIVITY.DAT the following record is associated with diesel powered excavators (some blank spaces have been deleted):

```
2270002036 Diesel Excavators      ALL 0 9999 0.59  hrs/yr  1092  DEFAULT
```

The fields of interest are the load factor (0.59) and the average hours of operation per year (1092). The other fields appear identical for all equipment and are intended for use in a future version of the model.

The data file with emissions factors for each pollutant is called EXHCO.EMF which contains the exhaust factors for CO. The following lines are associated with diesel excavators between 175 and 300 hp (some blank spaces and additional technology types have been deleted):

```
2270002036  175  300      Base      T0      T1      T2      g/hp-hr      CO
                3.98      4.13      1.14      1.14
```

Once again the source classification code appears followed by the minimum and maximum horsepower for the following emissions factors. Because all equipment is assumed to be Tier 1 (T1) the emissions factor will be 1.14 grams of CO per horsepower-hour. In this case an advance to Tier 2 would not produce an improvement, but it could for other pollutants and/or other equipment types and sizes.

To estimate the emissions per eight-hour day using Equation 1 all that is needed is to calculate the deterioration factor.

The following record is associated with Tier 1 diesel equipment in the file EXHCO.DAT:

```
T1                0.101        1.0        1.0        CO
```

The second field gives factor "A" from Equation 2; the third field gives factor "b"; and the fourth field gives the emissions cap in median life units (the largest number that can be used for "age" in Equation 2).

To determine the "age" used in Equation 3 it is now necessary to know the cumulative hours of operation and the "median engine life." This information is found from equipment type population survey's available for each state. For Ohio, the equipment population file OH.POP gives the expected useful life of a diesel excavator between 175 and 300 hp as 4,667 hours (some blank spaces have been deleted):

```
39000 2000 2270002036 Dsl - Excavators 175 300 233.3 4667 DFAULT
1577.2
```

It is now possible to calculate CO emissions for the excavator.

Starting with Equation 3:

$$\text{AGE} = (5 \text{ years} * 1092 \text{ hrs/yr}) * 0.59 / (4667 \text{ hours}) = 0.69$$

Then Equation 2:

$$\text{DF} = 1 + 0.101 * (0.69)^1 = 1.07$$

Finally Equation 3:

$$\text{EMS} = (1.14 \text{ g/hp-hr}) * (240 \text{ hp}) * (0.59) * (8 \text{ hr/day}) * (1.07) * (0.002205 \text{ lb/g}) = 3.05 \text{ lb/day}$$

The above process was used to estimate emissions of PM, CO, NO_x, and non-methane hydrocarbons (NMHC). All PM was assumed to be PM_{2.5}. SO₂ emissions were calculated by mass balance using the 2007 nonroad sulfur emission standard (500 ppm) and an average density of 7.1 lbs per gallon of diesel.

Each work crew was assumed to have one truck for every four people (USEC, 2005). Emissions were estimated assuming that each crew had a truck similar to a Ford F-150 Supercab meeting Tier 1 standards with at least 80,500 kilometers (50,000 miles) of use. Such a truck fits into the Heavy Duty-Light Truck classification. Table E-3 gives the emissions standards for this truck type. Each truck was assumed to be in use for a full eight-hour day (USEC, 2005) traveling at an average speed of five miles per hour.

Table E-3 Emissions from crew trucks

	NMHC	CO	NO _x	PM
grams/mile	0.56	7.3	1.53	0.12
grams/day	22.4	292	61.2	4.8

Notes:

To convert grams to ounces multiply by 0.35.

SO₂ emissions from crew trucks were calculated by mass balance using the 2007 gasoline sulfur standard (30 ppm) and an average fuel density of 6.1 lbs per gallon of gasoline.

Emissions from on-road heavy-duty delivery trucks and commuter cars and trucks were estimated using EPA's MOBILE6.2 model (EPA, 2002b). Long-haul diesel truck emission rates were estimated based on trucks operating in 2010 using national fleet age distribution. Medium-haul diesel trucks were based on the same parameters. Commuter vehicle emissions rates were applied using national defaults for fleet age distribution, but assumed that the fleet mix was half light duty gasoline vehicles and half light duty gasoline trucks. Table E-4 gives emission rates for delivery trucks and commuter vehicles.

Table E-4 Emissions rates for on-road vehicles (grams per mile)

	NMHC	CO	NO _x	PM ₁₀	SO ₂
Long-Haul Heavy Duty Diesel Delivery Trucks	0.36	1.3	5.61	0.11	0.01
Medium-Haul Heavy Duty Diesel Delivery Trucks	0.44	1.9	8.32	0.16	0.01
Commuter vehicles	0.83	10.6	0.66	0.03	0.01

Notes:

To convert grams per mile to ounces per mile multiply by 0.035.

Delivery trucks were modeled as elongated area sources originating at the facility's main entrance and taking larger roads to the north end of the construction area. Commuter vehicles were modeled as elongated area sources originating at the southwest construction access entrance and following interior roads to the parking lot south of the construction area. During the construction period an average of 28 one-way truck trips (9 long-haul and 19 medium-haul) per day and 2,612 one-way commuter trips per day were modeled. This assumed that each construction worker arrived in a single occupant vehicle.

Emissions rates for fugitive dust were estimated using guidelines outlined in the Western Regional Air Partnership fugitive dust handbook (WRAP, 2004). Although these guidelines were developed for use in western states they assume standard dust mitigation activities, such as wetting, so they were deemed applicable to a Midwestern setting. The handbook offers several options for selecting PM₁₀ factors depending on what information is known. Table E-5 shows the possible emissions factors and bases for choosing them.

Table E-5 PM₁₀ emissions factors recommended by the Western Regional Air Partnership Handbook

Basis for Emission Factor	Recommended PM10 Emission Factor
Only area and duration known	0.11 ton/acre/month (average conditions)
	or
	0.22 ton/acre/month (average, no mitigation)
	or
Volume of earth moved known	0.43 ton/acre/month (worst-case conditions)
	0.011 ton/acre/month for general construction
	plus
	0.059 ton/1000 yd ³ for on-site cut-fill
Equipment usage known	plus
	0.22 ton/1000 yd ³ for off-site cut-fill
	0.13 lb/acre/work-hr for general construction
	plus
	49 lb/scraper-hr for on-site haulage
	plus
	94 lb/hr for off-site haulage

Notes:
lb = pounds; yd³ = cubic yards; hr = hour

Because equipment usage is known, the third option is most appropriate for the proposed ACP. However, because the foundations have been dug and the fill has been hauled before the modeled construction period only the 0.13 pound/acre/work-hour factor was applied. Once PM₁₀ was estimated, the Western Regional Air Partnership recommended fractional factor of 0.209 was used to estimate PM_{2.5} from PM₁₀.

Fugitive dust emissions were only applied to new buildings and then only to the construction phase, not to other phases such as equipment installation.

E.1.2 Emissions from Plant Operations

Air emissions during plant operation were associated with the use of emergency backup generators burning diesel fuel as well as the on-road delivery trucks and commuter vehicles. These are the only non-radioactive emissions associated with the normal operation of the proposed proposed ACP.

Emissions factors for on-road vehicles were identical to those used for the construction phase. During plant operations, however, an average of 24 one-way delivery truck trips per day and 1,116 commuter one-way trips per day were modeled.

A number of diesel-powered emergency generators will be installed at the plant. The generators' total emissions rates for CO, NO_x, PM₁₀, PM_{2.5}, SO₂, and NMHC were modeled using specifications from a proprietary appendix to the Environmental Report (USEC, 2005).

Each generator was modeled as a point source located at the assigned building as identified in a proprietary index to the Environmental Report (USEC, 2005). Stack parameters were based on a typical 1,109 hp diesel generator described in Appendix 7 of CARB's Diesel Risk Reduction Plan (CARB, 2000) with the exception that the stack height was increased from 3 meters to 10 meters to reflect good engineering practice to avoid downwash effects assuming that the stacks are located on top of the building(s). Table E-7 lists the stack parameters used in modeling the generators.

Table E-7 Stack Parameters for Diesel Generators

Stack Temperature	Stack Height	Stack Diameter	Exit Velocity
787 °K	30 m (10 m above roof)	0.25 m	59.8 m/s

Notes:

K = °Kelvin; m = meter; m/s = meters per second.

To convert °K to °F use the following formula: °F = ((°K - 273.15) x 1.8) + 32

To convert meters to feet multiply by 3.3

E.1.3 Emissions from Manufacturing and Assembly

[The information on lines 28 through 48 is being withheld pursuant to 10 CFR 2.390.]

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[The information on lines 1 through 27 is being withheld pursuant to 10 CFR 2.390.]

[The information on lines 1 through 30 is being withheld pursuant to 10 CFR 2.390.]

E.2 Meteorological Inputs

Surface meteorological data, including wind data, have been collected at the on-site meteorological tower at the 10-, 30-, and 60-meters (33-, 98-, and 197-feet) levels. The tower is in the southern part of the reservation. A comparison of annual wind roses for the period 1995 through 2001 indicates that wind patterns at the 10-m (33-ft) level are different from those at the 30-m and 60-meters (98- and 197-feet) levels. Winds at the 10-m (33-ft) level appear to be influenced by local topographical and/or vegetative features. Accordingly, wind data at the 30-meters (98-foot) level, believed to be representative of the site,

were used in this analysis. This same meteorological data set was used in the radiological air quality assessment.

Seasonal temperatures from Waverly, OH (NOAA, 2000) and mean mixing heights were obtained from Huntington, WV (Holzworth, 1972). Table E-12 lists temperature data used in modeling and Table E-13 gives the mixing heights.

Table E-12 Seasonal temperatures (°K) for Waverly, OH (Climatology:1960-1991, NOAA)

	Minimum	Maximum	Average
Winter	267	273	279
Spring	277	284	291
Summer	289	296	302
Fall	278	285	292

Notes:

°K = °Kelvin

To convert °K to °F use the following formula: °F = ((°K - 273.15) x 1.8) + 32

Table E-13 Mean afternoon mixing heights (meters) for Huntington, WV (Holzworth, 1972)

Winter	1,079
Spring	1,986
Summer	1,641
Fall	1,340

Notes:

To convert meters to feet multiply by 3.3.

E.2 References

(CARB, 2000) California Air Resources Board. "Risk Reduction Plan to Reduce Particulate Matter from Diesel-Fueled Engines and Vehicles." Appendix 7, Sacramento, CA. October 2000.

(EPA, 1995) U.S. Environmental Protection Agency. "User's Guide for the Industrial Source Complex (ISC3) Dispersion Models." Volume 1. EPA-454/B-95-003a. September 1995.

(EPA, 2002a) U.S. Environmental Protection Agency. "User's Guide for the EPA Emissions Model Draft NONROAD 2002." EPA-420-P-02-013. December 2002.

(EPA, 2002b) User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model (Draft). EPA420-R-02-010. March 2002.

(Holzworth, 1972) Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution Throughout the Contiguous United States, EPA, Office of Air Programs, RTP, AP-101. 1972.

(NOAA, 2000) Climatology of the United States No. 20, 1971-2000., Waverly, Ohio, National Oceanic Atmospheric Administration, National Climate Data Center, North Carolina. 2000.

(USEC, 2005) Environmental Report for the American Centrifuge Plant in Piketon, Ohio, Revision 3. LA-3605-0002, Docket No. 70-7004. July 2005.

1 (WRAP, 2004) Western Regional Air Partnership. "Fugitive Dust Handbook." Prepared by Countess
2 Environmental, 4001 Whitesail Circle, Westlake Village, CA. under contract to the Western Governor
3 Association (WGA), WGA Contract No. 30204-83. November 2004.

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APPENDIX F
ENVIRONMENTAL JUSTICE ANALYSIS

APPENDIX F

ENVIRONMENTAL JUSTICE ANALYSIS

This appendix provides additional data for the assessment of the potential for disproportionately high and adverse human health or environmental effects on minority and/or low-income populations resulting from the proposed construction, operation, and decommissioning of the proposed American Centrifuge Plant (ACP).

Tables F-1 and F-2 present detailed year 2000 Census data for the environmental justice analysis at the State and county level, respectively. The tables provide minority and low-income population data for each Census tract within 80 kilometers (50 miles) of the proposed ACP. Census tracts exceeding minority or low-income criteria are shown in bold.

A summary of the number of Census tracts exceeding minority and/or low-income criteria is presented in Tables F-3 and F-4. Table F-3 summarizes information at the State level; Table F-4 summarizes information at the county level.

Refer to Chapter 3 of this Draft Environmental Impact Statement (EIS) for methods and references.

Table F-1 State Population Data, by Census Tract ^{a, b}

Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
State of Ohio	11353140	10.6	84.9	11.5	0.2	1.2	0.8	1.5	1.9	16
Threshold for EJ Concerns	NA	30.6	NA	31.5	20.2	21.2	20.8	21.5	21.9	36
Adams County										
39001990100	4868	22.4	96.8	0	1.3	0	0.1	1.7	0.8	3.9
39001990200	4635	13.1	98.4	0	0.2	0.2	0.1	1.1	0.6	1.9
39001990300	6212	12.6	98.8	0.1	0.1	0	0.2	0.8	0.3	1.5
39001990400	4630	17.6	97.8	0	1.3	0	0	1	0	2.2
39001990500	3454	21.7	96.3	0	1.6	0	0	2.1	0	3.7
39001990600	3531	19.6	99	0	0.1	0.1	0	0.8	0.5	1.5
Athens County										
39009972800	4272	27.7	97.4	0.4	0.8	0.4	0.3	0.6	1.8	4
39009972900	5362	29.8	90.9	3.1	0.4	3.1	0.3	2.1	0.5	9.5
39009973200	4320	17.4	87.8	3.7	0.5	4.4	0.5	2.5	2.2	13
39009973700	3967	13.9	95.7	1.2	0.6	0.8	0.2	1.6	1.4	5.7
39009973800	4642	11.3	98.4	0.2	0	0.7	0.1	0.5	0.5	2
Brown County										
39015951200	9522	6.2	98.3	0.2	0.1	0.3	0	1.1	0	1.7
39015951300	6435	12.3	98.7	0.3	0.2	0.3	0	0.5	0.3	1.6
39015951400	4408	14.4	98.6	0.4	0	0.1	0	0.8	0.5	1.9
39015951500	4896	12.3	98.5	0	0.9	0.4	0	0.2	0	1.5
39015951600	3869	16.5	97.4	1.1	0.3	0.2	0.2	0.8	1.4	3.5
39015951700	2764	15.3	92.8	4.8	0.1	0.1	0.1	2.1	0.6	7.6
39015951800	4650	12.2	97.4	2	0.2	0.1	0	0.3	0.4	2.9
39015951900	5741	12.1	99	0	0.2	0	0.3	0.5	0.6	1.2

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Clinton County										
2	39027994300	3871	10.3	97.6	0.9	0	0.1	0.4	1	0.1	2.4
3	39027994400	4808	4.4	98.1	0	0.7	0	0	1.2	0.2	2.1
4	39027995000	3967	7.9	99.3	0.1	0.2	0.1	0	0.4	0.1	0.7
5	39027995100	4105	8	97	0.1	1.2	0.2	0.9	0.6	1.2	3.2
6	Fairfield County										
7	39045031200	4901	6.1	99.3	0	0	0.1	0.3	0.3	1.3	1.8
8	39045032500	5996	6.1	83.8	14	0.4	0.1	0.3	1.1	0.7	16.2
9	39045032600	5840	5	99.1	0.1	0.2	0	0.1	0.5	0.4	1.2
10	Fayette County										
11	39047985800	3785	9.1	96.9	1.3	0.2	0	0.8	0.8	0.9	3.2
12	39047985900	3847	8.7	95.3	2.2	0.2	0.1	0.1	2	0.9	5.2
13	39047986000	4180	9.4	96.1	0.6	0.4	2.4	0	0.6	0.8	4.7
14	39047986100	4132	17.1	94	4	0	0	0	2	0	6
15	39047986200	4623	10.3	93	3.1	0.2	0.8	1.8	1.1	2.8	8.2
16	39047986300	3602	11	96.8	2.7	0.1	0	0	0.4	1	4
17	39047986400	4264	5.5	98.3	1	0	0	0.2	0.5	0.4	1.9
18	Gallia County										
19	39053953500	4929	14.3	94.5	3.4	0.3	0.8	0.2	0.8	0.4	5.7
20	39053953600	3974	19.7	95.5	2.3	0.2	0.6	0.1	1.3	0.6	4.8
21	39053953700	4067	27.4	95.6	0.7	0.2	1.2	0.2	1.9	0.3	4.6
22	39053953800	4322	19.4	98.2	0.3	0	0	0.2	1.3	0.7	2
23	39053953900	6790	13.6	94.4	4.1	0	0.4	0	1.2	0	5.6
24	39053954000	4489	17.2	92.4	3.4	0.8	1.5	0.5	1.5	0.9	8
25	39053954100	2498	20.7	93.8	3.4	0.3	0	0	2.5	0.4	6.2

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Highland County										
2	39071954400	3825	11	97.1	2.2	0.4	0	0.3	0	0.3	2.9
3	39071954500	4129	10.8	96.9	1.2	0	0	0.1	1.8	1.2	3.9
4	39071954600	4726	6.8	99	0.6	0	0.1	0	0.3	0	1
5	39071954700	5976	6.8	98.1	0	0.3	0.4	0	1.2	0	1.9
6	39071954800	4011	17.5	95.1	2.1	0.3	1.4	0.6	0.5	0.1	4.9
7	39071954900	3757	13.8	87.2	9	0.6	1.3	0	1.9	1	12.8
8	39071955000	4027	19.1	97.9	0.3	1.8	0	0	0	0.9	2.6
9	39071955100	5783	14	97.6	0.1	0.5	0.7	0	1	0.1	2.5
10	39071955200	4641	9.6	99.5	0	0.4	0	0	0.1	0.2	0.6
11	Hocking County										
12	39073964900	4400	7.3	98.7	0.3	0.7	0	0	0.4	0.1	1.4
13	39073965000	3888	15.7	99.6	0.2	0.2	0	0	0	0.7	1.1
14	39073965100	4134	10.5	97.9	0.4	0	0	0	1.7	0	2.1
15	39073965200	4302	15.9	98.7	0.8	0.2	0	0	0.3	0.2	1.5
16	39073965300	3548	10.9	99.5	0.4	0.2	0	0	0	0.1	0.7
17	39073965400	3991	18.9	96.1	0.7	0	1.6	0	1.5	0.6	4.2
18	39073965500	3978	16.2	93.5	4.6	0.1	0	0.3	1.5	0.3	6.5
19	Jackson County										
20	39079957200	5318	16.7	98.1	0.6	0	0.4	0.2	0.7	0.7	2.4
21	39079957300	3669	19.7	97	0.2	0.3	0.4	0.2	1.8	0.8	3.5
22	39079957400	5332	15.3	95.3	2.8	0.3	0.3	0.2	1.1	1.2	4.9
23	39079957500	5765	16	98.5	1.1	0	0.2	0	0.3	2.6	4.1
24	39079957600	2822	16.6	96.5	0.2	0.2	0.2	0	2.3	0.4	3.5
25	39079957700	5188	17.2	97.1	0.6	0.2	0.6	0	1.5	1.8	4.7
26	39079957800	4547	14.8	98.3	0.5	0.9	0	0	0.4	0.1	1.7

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Lawrence County										
2	39087050100	2692	15.2	95.9	2.8	0.2	0	0	1.1	0.8	4.9
3	39087050200	2524	20.8	97	2.5	0	0	0	0.5	0.3	3.3
4	39087050300	2349	33	78.1	19.6	0	1.4	0.2	0.5	0.9	22.3
5	39087050400	3155	25.1	97.8	1.6	0.3	0	0	0.3	0.4	2.3
6	39087050500	6585	19.1	97.6	0.1	0.3	1	0.2	0.7	0.9	2.9
7	39087050600	1677	28.1	94.5	1.4	0.3	0	0.4	3.5	0.4	5.5
8	39087050700	3749	26	99	0	0	0.7	0	0.3	0	1
9	39087050800	3843	22.6	97.4	1.8	0	0.7	0	0.1	0.2	2.8
10	39087050900	2279	18.4	98.3	0.3	0.4	0	0.4	0.7	1	2
11	39087051001	4475	13.9	95	3.7	0	0	0	1.3	0	5
12	39087051002	4316	14.5	96.7	1.6	0	0	0	1.7	0	3.3
13	39087051100	6977	21.2	92.2	5.7	0.6	0	0.5	1.1	0.5	7.8
14	39087051200	5299	15.7	98.6	0.3	0.3	0	0.1	0.6	1	1.9
15	39087051300	3705	18.4	98.7	0.3	0	0.1	0	1	0	1.3
16	39087051400	8694	12	97.5	1.1	0.3	0.6	0.2	0.3	0.4	2.8
17	Madison County										
18	39097041200	3282	7.6	97.8	0	0.1	0.9	0.2	1	1.4	3.3
19	Meigs County										
20	39105964200	4423	17.3	98.6	0.3	0.1	0	0.1	0.8	0.2	1.5
21	39105964300	4342	21.3	96.8	0.3	0.3	0	0.5	2	0.7	4
22	39105964400	3676	28.2	94.5	2.2	0.6	0.1	0	2.6	0	5.5
23	Pickaway County										
24	39129020100	2050	22.9	92.6	3.1	2.2	0	0	2.1	0.7	8.1
25	39129020200	2698	10.8	98.3	1.3	0	0	0	0.4	0.6	2.3

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39129020310	5089	6.2	96.5	1.1	0.2	0.8	0.1	1.2	0	3.5
2	39129020320	3335	6.8	93.8	2.2	1.1	1.7	1.1	0.2	2.4	7.5
3	39129020400	2543	25.6	98	1	0	0	0.2	0.8	0.3	2.2
4	39129021100	6910	5.5	97.9	0.1	0.3	0.8	0	1	0.4	2.4
5	39129021200	6424	8.9	97.3	0.3	0.9	0.1	0.1	1.3	0.5	3.1
6	39129021400	8992	7.7	88.1	9.8	0.3	0.1	0.1	1.5	0.7	12.2
7	39129021500	2987	9.2	99.2	0	0.1	0	0	0.7	1.3	1.9
8	39129021600	3528	12.7	98.1	0.4	0.5	0.1	0.1	0.9	0.1	2
9	39129021700	4506	7.1	99	0.6	0.4	0	0.1	0	1	1.9
10	Pike County										
11	39131952200	5592	16.2	94.2	1.9	1.4	0.2	0.6	1.8	0.3	5.9
12	39131952300	5067	18.6	95.9	1.2	0.3	0.5	0	2.1	0.4	4.4
13	39131952400	3368	10.7	95.5	1.3	1	1.4	0.1	0.7	0	4.5
14	39131952500	3753	17.7	97.9	0	0.1	0.5	0	1.5	0.6	2.1
15	39131952600	5573	20.6	96.9	0.2	2	0	0	1	0.3	3.4
16	39131952700	4342	25.7	98	0	1.1	0.3	0.3	0.3	1.7	3.4
17	Ross County										
18	39141955500	5388	5.2	98.6	0.1	0.2	0	0.2	0.8	0.7	1.8
19	39141955601	2047	7.5	98.5	0.8	0.4	0	0.3	0	1.9	3.4
20	39141955602	4954	4.8	57.1	39.3	0.2	0	0	4	2.2	44
21	39141955603	3861	11.8	98.3	0.6	0.1	0.5	0.2	0.3	0	1.7
22	39141955700	4267	12.5	98.5	0.4	0.4	0.1	0	0.5	0.4	1.9
23	39141955800	6824	9.8	94.9	3.5	0	0.1	0.5	1	0.7	5.4
24	39141955900	4257	10.4	87.9	8.7	0	0.8	0.2	2.5	0.1	12.2
25	39141956000	4549	12	90.1	6.8	1.3	0	0	1.8	0.2	10.1
26	39141956100	3774	9.4	84.9	11.8	0.2	0.8	0	2.3	0.3	15.4

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39141956200	2299	11	90.9	2.9	1.3	2.3	0.3	2.5	0.8	9.7
2	39141956300	2942	14.4	93.6	4.2	0	0.7	0	1.3	0.6	6.7
3	39141956400	3665	15.3	89.1	7.5	0.6	0.2	0.4	2.3	0.7	11.2
4	39141956500	4045	16.4	91.3	5.9	0.9	0	0	2	1.7	9.5
5	39141956600	5044	9.5	98.9	0.2	0	0.6	0	0.2	0.6	1.6
6	39141956700	5003	13.5	97	1	1.1	0.4	0.3	0.3	1	3.7
7	39141956800	6026	15.4	97.6	0.9	0.1	0.1	0	1.3	1.7	4
8	39141956900	4400	18	97.7	0.4	0	0.3	0	1.6	0	2.3
9	Scioto County										
10	39145992100	4960	17.4	98.3	0	0.2	0.1	0.6	0.7	0.6	1.7
11	39145992200	5180	12.8	79.9	16	0.4	0.1	0.3	3.4	2	20.8
12	39145992300	4867	16.1	96.7	0.2	1.5	0	0.3	1.3	0	3.3
13	39145992400	5626	21	97.2	0	0.2	0.7	0.3	1.6	1	3.2
14	39145992500	3188	17.8	95.4	0.5	0	0.6	0.5	2.9	1.5	5.1
15	39145992600	4164	16	98.2	0	0.2	0.1	0.1	1.2	1.4	2.3
16	39145992700	4538	12.5	96.7	0.2	0.2	0.2	0.1	2.5	0.4	3.3
17	39145992800	4486	18.8	95.7	2.5	1.1	0.3	0	0.4	0.3	4.7
18	39145992900	6372	15.4	98.1	0.7	0.4	0	0	0.8	0	1.9
19	39145993000	3878	20.8	96.9	0.3	0.9	1.3	0	0.6	0	3.1
20	39145993100	3495	21.9	98.5	0	0.4	0.3	0.1	0.6	0.1	1.5
21	39145993200	1861	31.5	97.6	0.3	0	0	0	2.1	0	2.4
22	39145993300	2698	14.1	94.6	2.4	0.8	1.8	0	0.5	0.9	6.3
23	39145993400	3801	28.5	93.1	3.9	0.5	0.2	0.2	2.1	0.3	7.1
24	39145993500	2859	29.3	97.2	0.2	0.8	0.2	0	1.6	1.5	4.4
25	39145993600	2596	43.4	88.8	7	0	1.2	0	2.9	0	11.2
26	39145993700	2618	24.6	75.4	20.3	0.4	0	0	4.2	1.4	25.6
27	39145993800	4689	8.1	95.6	0.7	0.2	1.9	0	1.6	0.2	4.6

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39145993900	3515	22.6	96.4	0	2.3	0.2	0	1.1	0	3.6
2	39145994000	3804	20.3	98.1	0.6	0.3	0.3	0.1	0.5	0.3	1.9
3	Vinton County										
4	39163953000	4509	17.8	98.3	0.3	0.5	0	0.1	0.8	0.4	2
5	39163953100	5284	21.4	97.3	0.1	0.5	0	0.2	1.9	0.8	3.4
6	39163953200	3013	20.8	98.4	0	0	0	0	1.6	0.5	2
7	State of Kentucky	4041769	15.8	90	7.3	0.2	0.7	0.5	1.2	1.4	10.7
8	Threshold for EJ Concerns	NA	35.8	NA	27.3	20.2	20.7	20.5	21.2	21.4	30.7
9	Boyd County										
10	21019030200	1182	25.9	81.2	9.2	0.5	4.9	1.2	3	0.6	19.4
11	21019030300	2542	32.3	96.6	3	0	0	0	0.4	0.2	3.6
12	21019030400	2072	27.9	93.1	2.3	0.2	0.2	1	3.2	2.3	7.1
13	21019030500	4489	11.1	97.3	1.6	0	0.9	0	0.2	0	2.7
14	21019030600	4169	9.9	97	1.6	0.1	0.2	0	1.1	0.2	3
15	21019030700	3578	8.7	95.8	0.8	0.5	0.1	1.1	1.6	0.4	4.3
16	21019030800	3969	29.4	97.6	0.5	0	0	0.2	1.8	1	3
17	21019030900	5772	13.7	99	0.2	0.3	0	0	0.5	0.3	1.3
18	21019031000	8122	12.6	88.7	7	0.4	0.3	1.1	2.3	4.7	14.1
19	21019031100	7764	10.9	98	0.5	0	0.2	0.1	1	0.5	2.1
20	21019031200	3374	11.5	99.1	0.9	0	0	0	0	0	0.9
21	21019031300	2719	19.2	97.1	1.1	0.2	0.3	0.1	1.3	0	2.9
22	Carter County										
23	21043960100	3370	26	98.5	0.7	0	0	0	0.8	0.7	2.2
24	21043960200	4334	25.5	99.3	0	0.1	0.3	0	0.3	0.2	0.9
25	21043960300	3080	20.8	100	0	0	0	0	0	0.6	0.6

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	21043960400	1696	25.6	98.8	0	0.9	0.2	0	0	0	1.2
2	21043960500	4183	18	99	0.3	0.5	0	0	0.2	0	1
3	21043960600	5863	18.6	99.3	0.2	0	0.2	0.3	0	0.2	0.7
4	21043960700	4363	24.5	98.1	0	0	1.2	0	0.7	1.3	2.9
5	Fleming County										
6	21069980100	3949	16.6	94.9	4.5	0	0	0.1	0.5	0.8	6
7	21069980200	3184	12.9	98.4	1	0.2	0	0	0.4	1.3	2.7
8	21069980400	4085	24.1	99.1	0.9	0	0	0	0	0	0.9
9	Greenup County										
10	21089040100	4375	5.5	98.1	0.2	0.2	0.8	0.3	0.3	1.9	3.5
11	21089040200	7475	12.2	97.8	0.6	0.2	0.1	0.5	0.8	1.9	3.5
12	21089040300	4531	11.3	97	0.3	0	1.5	0.1	1	0.4	3.3
13	21089040400	5562	14.6	98.5	0.6	0	0.2	0.1	0.6	0.2	1.6
14	21089040500	8110	18.7	96.7	1.6	0	0.4	0.2	1.1	0.3	3.4
15	21089040600	3310	18	98.1	0	0.2	0.2	0	1.5	0	1.9
16	21089040700	3528	17.6	99.1	0	0.2	0.3	0	0.3	0	0.9
17	Lewis County										
18	21135990100	4716	29.1	99.7	0	0.2	0	0	0.1	0.2	0.5
19	21135990200	3990	33.6	98.9	0.4	0.2	0	0	0.5	0.5	1.6
20	21135990300	3293	22.5	97	0.8	0.6	0	0.7	0.9	0.7	3.2
21	21135990400	2093	27.1	100	0	0	0	0	0	0	0

Table F-1 State Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Mason County										
2	21161960100	3093	14.3	97.3	1.6	0	0	0.2	0.9	0.8	3.3
3	21161960200	3478	24.7	84.5	12.2	0.2	0	0.9	2.3	1.3	15.7
4	21161960300	4337	16.8	85.7	10.3	0.1	1.1	0.9	1.9	1.5	15.6
5	21161960400	4140	11.4	94.7	2.4	0.4	0.7	0.5	1.5	1	5.7
6	Carter County										
7	21205950100	6103	16.5	94.4	2.2	0.5	0.9	1	1	2	6.5
8	State of West Virginia	1808344	17.9	95	3.1	0.2	0.5	0.2	1	0.7	5.5
9	Threshold for EJ Concerns	NA	37.9	NA	23.1	20.2	20.5	20.2	21	20.7	25.5
10	Cabell County										
11	54011000600	1607	58.9	89.3	4	1.2	5	0.4	0	0.9	10.7
12	54011000900	1852	30.7	95.3	3.2	0	0	0.3	1.2	0.3	4.7
13	54011001000	2426	29.6	97.7	1.1	0	0	0	1.3	0.4	2.7
14	54011001100	2096	28.1	93.6	2	0	0	0	4.5	2.6	6.4
15	54011010700	7160	15.5	98.1	0.3	0	0.3	0.1	1.2	0.4	2.2
16	Mason County										
17	54053954800	6909	16.3	98.5	0.6	0.2	0	0	0.6	0.2	1.7
18	54053954900	6750	24	98.8	0.6	0	0.4	0	0.1	0.6	1.7
19	54053955000	5025	17.6	96.5	1.8	0	1.5	0	0.2	0.5	4
20	54053955100	7273	21.2	99	0	0.2	0.1	0	0.7	0.2	1.3
21	Wayne County										
22	54099005100	2181	13.7	98.4	0	0.6	0.7	0	0.3	0	1.6
23	54099005200	2086	14.1	98.8	0	0	0.9	0.3	0	0.3	1.2
24	54099020100	2545	13.1	99.3	0.4	0.4	0	0	0	0	0.7

Table F-1 State Population Data, by Census Tract (continued)

Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
54099020300	5307	16.4	99	0.4	0	0.2	0.1	0.3	0.4	1.3
54099020400	6219	11.8	99.3	0	0	0	0.2	0.5	1.1	1.6

Notes:

^a NA = Not available.

^b Census tracts exceeding minority/low-income criteria are shown in bold.

Table F-2 County Population Data, by Census Tract ^{a, b}

Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
Ohio										
Adams County	39001	6	17.4	0	0.7	0	0.1	1.2	0.4	2.4
Threshold for EJ Concerns	NA	26	NA	20	20.7	20	20.1	21.2	20.4	22.4
39001990100	4868	22.4	96.8	0	1.3	0	0.1	1.7	0.8	3.9
39001990200	4635	13.1	98.4	0	0.2	0.2	0.1	1.1	0.6	1.9
39001990300	6212	12.6	98.8	0.1	0.1	0	0.2	0.8	0.3	1.5
39001990400	4630	17.6	97.8	0	1.3	0	0	1	0	2.2
39001990500	3454	21.7	96.3	0	1.6	0	0	2.1	0	3.7
39001990600	3531	19.6	99	0	0.1	0.1	0	0.8	0.5	1.5
Ohio										
Athens County	39009	5	27.4	2.4	0.5	1.8	0.3	1.6	1	7.3
Threshold for EJ Concerns	NA	25	NA	22.4	20.5	21.8	20.3	21.6	21	27.3
39009972800	4272	27.7	97.4	0.4	0.8	0.4	0.3	0.6	1.8	4
39009972900	5362	29.8	90.9	3.1	0.4	3.1	0.3	2.1	0.5	9.5
39009973200	4320	17.4	87.8	3.7	0.5	4.4	0.5	2.5	2.2	13
39009973700	3967	13.9	95.7	1.2	0.6	0.8	0.2	1.6	1.4	5.7
39009973800	4642	11.3	98.4	0.2	0	0.7	0.1	0.5	0.5	2

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Ohio										
2	Brown County	39015	8	11.6	0.8	0.2	0.2	0.1	0.7	0.4	2.3
3	Threshold for EJ Concerns	NA	28	NA	20.8	20.2	20.2	20.1	20.7	20.4	22.3
4	39015951200	9522	6.2	98.3	0.2	0.1	0.3	0	1.1	0	1.7
5	39015951300	6435	12.3	98.7	0.3	0.2	0.3	0	0.5	0.3	1.6
6	39015951400	4408	14.4	98.6	0.4	0	0.1	0	0.8	0.5	1.9
7	39015951500	4896	12.3	98.5	0	0.9	0.4	0	0.2	0	1.5
8	39015951600	3869	16.5	97.4	1.1	0.3	0.2	0.2	0.8	1.4	3.5
9	39015951700	2764	15.3	92.8	4.8	0.1	0.1	0.1	2.1	0.6	7.6
10	39015951800	4650	12.2	97.4	2	0.2	0.1	0	0.3	0.4	2.9
11	39015951900	5741	12.1	99	0	0.2	0	0.3	0.5	0.6	1.2
12	Ohio										
13	Clinton County	39027	4	8.6	2.1	0.3	0.2	0.4	1.1	0.9	4.7
14	Threshold for EJ Concerns	NA	24	NA	22.1	20.3	20.2	20.4	21.1	20.9	24.7
15	39027994300	3871	10.3	97.6	0.9	0	0.1	0.4	1	0.1	2.4
16	39027994400	4808	4.4	98.1	0	0.7	0	0	1.2	0.2	2.1
17	39027995000	3967	7.9	99.3	0.1	0.2	0.1	0	0.4	0.1	0.7
18	39027995100	4105	8	97	0.1	1.2	0.2	0.9	0.6	1.2	3.2

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Ohio										
2	Fairfield County	39045	3	5.9	2.6	0.3	0.7	0.3	1	1	5.5
3	Threshold for EJ Concerns	NA	23	NA	22.6	20.3	20.7	20.3	21	21	25.5
4	39045031200	4901	6.1	99.3	0	0	0.1	0.3	0.3	1.3	1.8
5	39045032500	5996	6.1	83.8	14	0.4	0.1	0.3	1.1	0.7	16.2
6	39045032600	5840	5	99.1	0.1	0.2	0	0.1	0.5	0.4	1.2
7	Ohio										
8	Fayette County	39047	7	10.1	2.1	0.2	0.5	0.4	1.1	1	4.8
9	Threshold for EJ Concerns	NA	27	NA	22.1	20.2	20.5	20.4	21.1	21	24.8
10	39047985800	3785	9.1	96.9	1.3	0.2	0	0.8	0.8	0.9	3.2
11	39047985900	3847	8.7	95.3	2.2	0.2	0.1	0.1	2	0.9	5.2
12	39047986000	4180	9.4	96.1	0.6	0.4	2.4	0	0.6	0.8	4.7
13	39047986100	4132	17.1	94	4	0	0	0	2	0	6
14	39047986200	4623	10.3	93	3.1	0.2	0.8	1.8	1.1	2.8	8.2
15	39047986300	3602	11	96.8	2.7	0.1	0	0	0.4	1	4
16	39047986400	4264	5.5	98.3	1	0	0	0.2	0.5	0.4	1.9
17	Ohio										
18	Gallia County	39053	7	18.1	2.6	0.2	0.7	0.2	1.4	0.4	5.3
19	Threshold for EJ Concerns	NA	27	NA	22.6	20.2	20.7	20.2	21.4	20.4	25.3
20	39053953500	4929	14.3	94.5	3.4	0.3	0.8	0.2	0.8	0.4	5.7
21	39053953600	3974	19.7	95.5	2.3	0.2	0.6	0.1	1.3	0.6	4.8
22	39053953700	4067	27.4	95.6	0.7	0.2	1.2	0.2	1.9	0.3	4.6
23	39053953800	4322	19.4	98.2	0.3	0	0	0.2	1.3	0.7	2

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39053953900	6790	13.6	94.4	4.1	0	0.4	0	1.2	0	5.6
2	39053954000	4489	17.2	92.4	3.4	0.8	1.5	0.5	1.5	0.9	8
3	39053954100	2498	20.7	93.8	3.4	0.3	0	0	2.5	0.4	6.2
4	Ohio										
5	Highland County	39071	9	11.8	1.5	0.5	0.4	0.1	0.8	0.4	3.4
6	Threshold for EJ Concerns	NA	29	NA	21.5	20.5	20.4	20.1	20.8	20.4	23.4
7	39071954400	3825	11	97.1	2.2	0.4	0	0.3	0	0.3	2.9
8	39071954500	4129	10.8	96.9	1.2	0	0	0.1	1.8	1.2	3.9
9	39071954600	4726	6.8	99	0.6	0	0.1	0	0.3	0	1
10	39071954700	5976	6.8	98.1	0	0.3	0.4	0	1.2	0	1.9
11	39071954800	4011	17.5	95.1	2.1	0.3	1.4	0.6	0.5	0.1	4.9
12	39071954900	3757	13.8	87.2	9	0.6	1.3	0	1.9	1	12.8
13	39071955000	4027	19.1	97.9	0.3	1.8	0	0	0	0.9	2.6
14	39071955100	5783	14	97.6	0.1	0.5	0.7	0	1	0.1	2.5
15	39071955200	4641	9.6	99.5	0	0.4	0	0	0.1	0.2	0.6
16	Ohio										
17	Hocking County	39073	7	13.5	1	0.2	0.2	0	0.8	0.3	2.5
18	Threshold for EJ Concerns	NA	27	NA	21	20.2	20.2	20	20.8	20.3	22.5
19	39073964900	4400	7.3	98.7	0.3	0.7	0	0	0.4	0.1	1.4
20	39073965000	3888	15.7	99.6	0.2	0.2	0	0	0	0.7	1.1
21	39073965100	4134	10.5	97.9	0.4	0	0	0	1.7	0	2.1
22	39073965200	4302	15.9	98.7	0.8	0.2	0	0	0.3	0.2	1.5
23	39073965300	3548	10.9	99.5	0.4	0.2	0	0	0	0.1	0.7
24	39073965400	3991	18.9	96.1	0.7	0	1.6	0	1.5	0.6	4.2

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39073965500	3978	16.2	93.5	4.6	0.1	0	0.3	1.5	0.3	6.5
2	Ohio										
3	Jackson County	39079	7	16.5	0.9	0.3	0.3	0.1	1.1	1.2	3.6
4	Threshold for EJ Concerns	NA	27	NA	20.9	20.3	20.3	20.1	21.1	21.2	23.6
5	39079957200	5318	16.7	98.1	0.6	0	0.4	0.2	0.7	0.7	2.4
6	39079957300	3669	19.7	97	0.2	0.3	0.4	0.2	1.8	0.8	3.5
7	39079957400	5332	15.3	95.3	2.8	0.3	0.3	0.2	1.1	1.2	4.9
8	39079957500	5765	16	98.5	1.1	0	0.2	0	0.3	2.6	4.1
9	39079957600	2822	16.6	96.5	0.2	0.2	0.2	0	2.3	0.4	3.5
10	39079957700	5188	17.2	97.1	0.6	0.2	0.6	0	1.5	1.8	4.7
11	39079957800	4547	14.8	98.3	0.5	0.9	0	0	0.4	0.1	1.7
12	Ohio										
13	Lawrence County	39087	15	18.9	2.4	0.2	0.3	0.1	0.8	0.5	4.2
14	Threshold for EJ Concerns	NA	35	NA	22.4	20.2	20.3	20.1	20.8	20.5	24.2
15	39087050100	2692	15.2	95.9	2.8	0.2	0	0	1.1	0.8	4.9
16	39087050200	2524	20.8	97	2.5	0	0	0	0.5	0.3	3.3
17	39087050300	2349	33	78.1	19.6	0	1.4	0.2	0.5	0.9	22.3
18	39087050400	3155	25.1	97.8	1.6	0.3	0	0	0.3	0.4	2.3
19	39087050500	6585	19.1	97.6	0.1	0.3	1	0.2	0.7	0.9	2.9
20	39087050600	1677	28.1	94.5	1.4	0.3	0	0.4	3.5	0.4	5.5
21	39087050700	3749	26	99	0	0	0.7	0	0.3	0	1
22	39087050800	3843	22.6	97.4	1.8	0	0.7	0	0.1	0.2	2.8
23	39087050900	2279	18.4	98.3	0.3	0.4	0	0.4	0.7	1	2
24	39087051001	4475	13.9	95	3.7	0	0	0	1.3	0	5

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39087051002	4316	14.5	96.7	1.6	0	0	0	1.7	0	3.3
2	39087051100	6977	21.2	92.2	5.7	0.6	0	0.5	1.1	0.5	7.8
3	39087051200	5299	15.7	98.6	0.3	0.3	0	0.1	0.6	1	1.9
4	39087051300	3705	18.4	98.7	0.3	0	0.1	0	1	0	1.3
5	39087051400	8694	12	97.5	1.1	0.3	0.6	0.2	0.3	0.4	2.8
6	Ohio										
7	Madison County	39097	1	7.8	6	0.2	0.5	0.2	1.5	0.7	8.7
8	Threshold for EJ Concerns	NA	21	NA	26	20.2	20.5	20.2	21.5	20.7	28.7
9	39097041200	3282	7.6	97.8	0	0.1	0.9	0.2	1	1.4	3.3
10	Ohio										
11	Meigs County	39105	3	19.8	0.6	0.3	0.2	0.3	1.3	0.6	3
12	Threshold for EJ Concerns	NA	23	NA	20.6	20.3	20.2	20.3	21.3	20.6	23
13	39105964200	4423	17.3	98.6	0.3	0.1	0	0.1	0.8	0.2	1.5
14	39105964300	4342	21.3	96.8	0.3	0.3	0	0.5	2	0.7	4
15	39105964400	3676	28.2	94.5	2.2	0.6	0.1	0	2.6	0	5.5
16	Ohio										
17	Pickaway County	39129	11	9.5	5.7	0.5	0.3	0.2	1.1	0.8	8.3
18	Threshold for EJ Concerns	NA	31	NA	25.7	20.5	20.3	20.2	21.1	20.8	28.3
19	39129020100	2050	22.9	92.6	3.1	2.2	0	0	2.1	0.7	8.1
20	39129020200	2698	10.8	98.3	1.3	0	0	0	0.4	0.6	2.3
21	39129020310	5089	6.2	96.5	1.1	0.2	0.8	0.1	1.2	0	3.5
22	39129020320	3335	6.8	93.8	2.2	1.1	1.7	1.1	0.2	2.4	7.5
23	39129020400	2543	25.6	98	1	0	0	0.2	0.8	0.3	2.2

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39129021100	6910	5.5	97.9	0.1	0.3	0.8	0	1	0.4	2.4
2	39129021200	6424	8.9	97.3	0.3	0.9	0.1	0.1	1.3	0.5	3.1
3	39129021400	8992	7.7	88.1	9.8	0.3	0.1	0.1	1.5	0.7	12.2
4	39129021500	2987	9.2	99.2	0	0.1	0	0	0.7	1.3	1.9
5	39129021600	3528	12.7	98.1	0.4	0.5	0.1	0.1	0.9	0.1	2
6	39129021700	4506	7.1	99	0.6	0.4	0	0.1	0	1	1.9
7	Ohio										
8	Pike County	39131	6	18.6	0.8	1	0.4	0.2	1.3	0.5	4
9	Threshold for EJ Concerns	NA	26	NA	20.8	21	20.4	20.2	21.3	20.5	24
10	39131952200	5592	16.2	94.2	1.9	1.4	0.2	0.6	1.8	0.3	5.9
11	39131952300	5067	18.6	95.9	1.2	0.3	0.5	0	2.1	0.4	4.4
12	39131952400	3368	10.7	95.5	1.3	1	1.4	0.1	0.7	0	4.5
13	39131952500	3753	17.7	97.9	0	0.1	0.5	0	1.5	0.6	2.1
14	39131952600	5573	20.6	96.9	0.2	2	0	0	1	0.3	3.4
15	39131952700	4342	25.7	98	0	1.1	0.3	0.3	0.3	1.7	3.4
16	Ohio										
17	Ross County	39141	17	12	5.7	0.4	0.3	0.1	1.4	0.8	8.5
18	Threshold for EJ Concerns	NA	37	NA	25.7	20.4	20.3	20.1	21.4	20.8	28.5
19	39141955500	5388	5.2	98.6	0.1	0.2	0	0.2	0.8	0.7	1.8
20	39141955601	2047	7.5	98.5	0.8	0.4	0	0.3	0	1.9	3.4
21	39141955602	4954	4.8	57.1	39.3	0.2	0	0	4	2.2	44
22	39141955603	3861	11.8	98.3	0.6	0.1	0.5	0.2	0.3	0	1.7
23	39141955700	4267	12.5	98.5	0.4	0.4	0.1	0	0.5	0.4	1.9
24	39141955800	6824	9.8	94.9	3.5	0	0.1	0.5	1	0.7	5.4

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39141955900	4257	10.4	87.9	8.7	0	0.8	0.2	2.5	0.1	12.2
2	39141956000	4549	12	90.1	6.8	1.3	0	0	1.8	0.2	10.1
3	39141956100	3774	9.4	84.9	11.8	0.2	0.8	0	2.3	0.3	15.4
4	39141956200	2299	11	90.9	2.9	1.3	2.3	0.3	2.5	0.8	9.7
5	39141956300	2942	14.4	93.6	4.2	0	0.7	0	1.3	0.6	6.7
6	39141956400	3665	15.3	89.1	7.5	0.6	0.2	0.4	2.3	0.7	11.2
7	39141956500	4045	16.4	91.3	5.9	0.9	0	0	2	1.7	9.5
8	39141956600	5044	9.5	98.9	0.2	0	0.6	0	0.2	0.6	1.6
9	39141956700	5003	13.5	97	1	1.1	0.4	0.3	0.3	1	3.7
10	39141956800	6026	15.4	97.6	0.9	0.1	0.1	0	1.3	1.7	4
11	39141956900	4400	18	97.7	0.4	0	0.3	0	1.6	0	2.3
12	Ohio										
13	Scioto County	39145	20	19.3	2.6	0.5	0.5	0.2	1.5	0.6	5.5
14	Threshold for EJ Concerns	NA	40	NA	22.6	20.5	20.5	20.2	21.5	20.6	25.5
15	39145992100	4960	17.4	98.3	0	0.2	0.1	0.6	0.7	0.6	1.7
16	39145992200	5180	12.8	79.9	16	0.4	0.1	0.3	3.4	2	20.8
17	39145992300	4867	16.1	96.7	0.2	1.5	0	0.3	1.3	0	3.3
18	39145992400	5626	21	97.2	0	0.2	0.7	0.3	1.6	1	3.2
19	39145992500	3188	17.8	95.4	0.5	0	0.6	0.5	2.9	1.5	5.1
20	39145992600	4164	16	98.2	0	0.2	0.1	0.1	1.2	1.4	2.3
21	39145992700	4538	12.5	96.7	0.2	0.2	0.2	0.1	2.5	0.4	3.3
22	39145992800	4486	18.8	95.7	2.5	1.1	0.3	0	0.4	0.3	4.7
23	39145992900	6372	15.4	98.1	0.7	0.4	0	0	0.8	0	1.9
24	39145993000	3878	20.8	96.9	0.3	0.9	1.3	0	0.6	0	3.1
25	39145993100	3495	21.9	98.5	0	0.4	0.3	0.1	0.6	0.1	1.5

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	39145993200	1861	31.5	97.6	0.3	0	0	0	2.1	0	2.4
2	39145993300	2698	14.1	94.6	2.4	0.8	1.8	0	0.5	0.9	6.3
3	39145993400	3801	28.5	93.1	3.9	0.5	0.2	0.2	2.1	0.3	7.1
4	39145993500	2859	29.3	97.2	0.2	0.8	0.2	0	1.6	1.5	4.4
5	39145993600	2596	43.4	88.8	7	0	1.2	0	2.9	0	11.2
6	39145993700	2618	24.6	75.4	20.3	0.4	0	0	4.2	1.4	25.6
7	39145993800	4689	8.1	95.6	0.7	0.2	1.9	0	1.6	0.2	4.6
8	39145993900	3515	22.6	96.4	0	2.3	0.2	0	1.1	0	3.6
9	39145994000	3804	20.3	98.1	0.6	0.3	0.3	0.1	0.5	0.3	1.9
10	Ohio										
11	Vinton County	39163	3	20	0.1	0.4	0	0.1	1.4	0.6	2.5
12	Threshold for EJ Concerns	NA	23	NA	20.1	20.4	20	20.1	21.4	20.6	22.5
13	39163953000	4509	17.8	98.3	0.3	0.5	0	0.1	0.8	0.4	2
14	39163953100	5284	21.4	97.3	0.1	0.5	0	0.2	1.9	0.8	3.4
15	39163953200	3013	20.8	98.4	0	0	0	0	1.6	0.5	2
16	Kentucky										
17	Boyd County	21019	12	15.5	2.2	0.2	0.3	0.4	1.2	1.1	5
18	Threshold for EJ Concerns	NA	32	NA	22.2	20.2	20.3	20.4	21.2	21.1	25
19	21019030200	1182	25.9	81.2	9.2	0.5	4.9	1.2	3	0.6	19.4
20	21019030300	2542	32.3	96.6	3	0	0	0	0.4	0.2	3.6
21	21019030400	2072	27.9	93.1	2.3	0.2	0.2	1	3.2	2.3	7.1
22	21019030500	4489	11.1	97.3	1.6	0	0.9	0	0.2	0	2.7
23	21019030600	4169	9.9	97	1.6	0.1	0.2	0	1.1	0.2	3
24	21019030700	3578	8.7	95.8	0.8	0.5	0.1	1.1	1.6	0.4	4.3

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	21019030800	3969	29.4	97.6	0.5	0	0	0.2	1.8	1	3
2	21019030900	5772	13.7	99	0.2	0.3	0	0	0.5	0.3	1.3
3	21019031000	8122	12.6	88.7	7	0.4	0.3	1.1	2.3	4.7	14.1
4	21019031100	7764	10.9	98	0.5	0	0.2	0.1	1	0.5	2.1
5	21019031200	3374	11.5	99.1	0.9	0	0	0	0	0	0.9
6	21019031300	2719	19.2	97.1	1.1	0.2	0.3	0.1	1.3	0	2.9
7	Kentucky										
8	Carter County	21043	7	22.3	0.2	0.2	0.3	0.1	0.3	0.4	1.3
9	Threshold for EJ Concerns	NA	27	NA	20.2	20.2	20.3	20.1	20.3	20.4	21.3
10	21043960100	3370	26	98.5	0.7	0	0	0	0.8	0.7	2.2
11	21043960200	4334	25.5	99.3	0	0.1	0.3	0	0.3	0.2	0.9
12	21043960300	3080	20.8	100	0	0	0	0	0	0.6	0.6
13	21043960400	1696	25.6	98.8	0	0.9	0.2	0	0	0	1.2
14	21043960500	4183	18	99	0.3	0.5	0	0	0.2	0	1
15	21043960600	5863	18.6	99.3	0.2	0	0.2	0.3	0	0.2	0.7
16	21043960700	4363	24.5	98.1	0	0	1.2	0	0.7	1.3	2.9
17	Kentucky										
18	Fleming County	21069	3	18.6	1.8	0.1	0	0	0.4	0.8	3
19	Threshold for EJ Concerns	NA	23	NA	21.8	20.1	20	20	20.4	20.8	23
20	21069980100	3949	16.6	94.9	4.5	0	0	0.1	0.5	0.8	6
21	21069980200	3184	12.9	98.4	1	0.2	0	0	0.4	1.3	2.7
22	21069980400	4085	24.1	99.1	0.9	0	0	0	0	0	0.9

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Kentucky										
2	Greenup County	21089	7	14.1	0.6	0.1	0.4	0.2	0.8	0.8	2.8
3	Threshold for EJ Concerns	NA	27	NA	20.6	20.1	20.4	20.2	20.8	20.8	22.8
4	21089040100	4375	5.5	98.1	0.2	0.2	0.8	0.3	0.3	1.9	3.5
5	21089040200	7475	12.2	97.8	0.6	0.2	0.1	0.5	0.8	1.9	3.5
6	21089040300	4531	11.3	97	0.3	0	1.5	0.1	1	0.4	3.3
7	21089040400	5562	14.6	98.5	0.6	0	0.2	0.1	0.6	0.2	1.6
8	21089040500	8110	18.7	96.7	1.6	0	0.4	0.2	1.1	0.3	3.4
9	21089040600	3310	18	98.1	0	0.2	0.2	0	1.5	0	1.9
10	21089040700	3528	17.6	99.1	0	0.2	0.3	0	0.3	0	0.9
11	Kentucky										
12	Lewis County	21135	4	28.5	0.3	0.3	0	0.2	0.4	0.4	1.4
13	Threshold for EJ Concerns	NA	24	NA	20.3	20.3	20	20.2	20.4	20.4	21.4
14	21135990100	4716	29.1	99.7	0	0.2	0	0	0.1	0.2	0.5
15	21135990200	3990	33.6	98.9	0.4	0.2	0	0	0.5	0.5	1.6
16	21135990300	3293	22.5	97	0.8	0.6	0	0.7	0.9	0.7	3.2
17	21135990400	2093	27.1	100	0	0	0	0	0	0	0

Table F-2 County Population Data, by Census Tract (continued)

	Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
1	Kentucky										
2	Mason County	21161	4	16.8	6.4	0.1	0.5	0.9	1.5	1.4	9.9
3	Threshold for EJ Concerns	NA	24	NA	26.4	20.1	20.5	20.9	21.5	21.4	29.9
4	21161960100	3093	14.3	97.3	1.6	0	0	0.2	0.9	0.8	3.3
5	21161960200	3478	24.7	84.5	12.2	0.2	0	0.9	2.3	1.3	15.7
6	21161960300	4337	16.8	85.7	10.3	0.1	1.1	0.9	1.9	1.5	15.6
7	21161960400	4140	11.4	94.7	2.4	0.4	0.7	0.5	1.5	1	5.7
8	Kentucky										
9	Carter County	21043	7	22.3	0.2	0.2	0.3	0.1	0.3	0.4	1.3
10	Threshold for EJ Concerns	NA	27	NA	20.2	20.2	20.3	20.1	20.3	20.4	21.3
11	21205950100	6103	16.5	94.4	2.2	0.5	0.9	1	1	2	6.5
12	West Virginia										
13	Cabell County	54011	5	19.2	4	0.2	0.9	0.3	1.3	0.6	7
14	Threshold for EJ Concerns	NA	25	NA	24	20.2	20.9	20.3	21.3	20.6	27
15	54011000600	1607	58.9	89.3	4	1.2	5	0.4	0	0.9	10.7
16	54011000900	1852	30.7	95.3	3.2	0	0	0.3	1.2	0.3	4.7
17	54011001000	2426	29.6	97.7	1.1	0	0	0	1.3	0.4	2.7
18	54011001100	2096	28.1	93.6	2	0	0	0	4.5	2.6	6.4
19	54011010700	7160	15.5	98.1	0.3	0	0.3	0.1	1.2	0.4	2.2

Table F-2 County Population Data, by Census Tract (continued)

Census Tract	Persons	Below Poverty Level (%)	Whites (%)	African American/ Black (%)	Native American (%)	Asian and Pacific Islander (%)	Other Races (%)	Two or More Races (%)	Hispanic or Latino (%)	Minorities (%)
West Virginia										
Mason County	54053	4	19.9	0.7	0.1	0.4	0	0.4	0.4	2
Threshold for EJ Concerns	NA	24	NA	20.7	20.1	20.4	20	20.4	20.4	22
54053954800	6909	16.3	98.5	0.6	0.2	0	0	0.6	0.2	1.7
54053954900	6750	24	98.8	0.6	0	0.4	0	0.1	0.6	1.7
54053955000	5025	17.6	96.5	1.8	0	1.5	0	0.2	0.5	4
54053955100	7273	21.2	99	0	0.2	0.1	0	0.7	0.2	1.3
West Virginia										
Wayne County	54099	5	19.6	0.1	0.2	0.2	0.1	0.5	0.3	1.4
Threshold for EJ Concerns	NA	25	NA	20.1	20.2	20.2	20.1	20.5	20.3	21.4
54099005100	2181	13.7	98.4	0	0.6	0.7	0	0.3	0	1.6
54099005200	2086	14.1	98.8	0	0	0.9	0.3	0	0.3	1.2
54099020100	2545	13.1	99.3	0.4	0.4	0	0	0	0	0.7
54099020300	5307	16.4	99	0.4	0	0.2	0.1	0.3	0.4	1.3
54099020400	6219	11.8	99.3	0	0	0	0.2	0.5	1.1	1.6

Notes:

^a NA = Not available.

^b Census tracts exceeding minority/low-income criteria are shown in bold.

Table F-3 Number of Census Tracts Exceeding State Environmental Justice Threshold ^a

County	Below Poverty Level	African American/ Black	Native American	Asian and Pacific Islander	Other Races	Two or More Races	Hispanic or Latino (All Races)	Minorities (Racial Minorities plus White Hispanics)	Total Minority Tracts
State of Ohio (%)	10.6	11.5	0.2	1.2	0.8	1.5	1.9	16	--
Threshold for EJ Concerns (%)	30.6	31.5	20.2	21.2	20.8	21.5	21.9	36	--
Adams	0	0	0	0	0	0	0	0	0
Athens	0	0	0	0	0	0	0	0	0
Brown	0	0	0	0	0	0	0	0	0
Clinton	0	0	0	0	0	0	0	0	0
Fairfield	0	0	0	0	0	0	0	0	0
Fayette	0	0	0	0	0	0	0	0	0
Gallia	0	0	0	0	0	0	0	0	0
Highland	0	0	0	0	0	0	0	0	0
Hocking	0	0	0	0	0	0	0	0	0
Jackson	0	0	0	0	0	0	0	0	0
Lawrence	1	0	0	0	0	0	0	0	NA
Madison	0	0	0	0	0	0	0	0	0
Meigs	0	0	0	0	0	0	0	0	0
Pickaway	0	0	0	0	0	0	0	0	0
Pike	0	0	0	0	0	0	0	0	0
Ross	0	1	0	0	0	0	0	1	NA
Scioto	2	0	0	0	0	0	0	0	NA
Vinton	0	0	0	0	0	0	0	0	0
Total Ohio Counties	3	1	0	0	0	0	0	1	NA

Table F-3 Number of Census Tracts Exceeding State Environmental Justice Threshold (continued)

	County	Below Poverty Level	African American/ Black	Native American	Asian and Pacific Islander	Other Races	Two or More Races	Hispanic or Latino (All Races)	Minorities (Racial Minorities plus White Hispanics)	Total Minority Tracts
1	State of Kentucky (%)	15.8	7.3	0.2	0.7	0.5	1.2	1.4	10.7	--
2	Threshold for EJ									
3	Concerns (%)	35.8	27.3	20.2	20.7	20.5	21.2	21.4	30.7	--
4	Boyd	0	0	0	0	0	0	0	0	0
5	Carter	0	0	0	0	0	0	0	0	0
6	Fleming	0	0	0	0	0	0	0	0	0
7	Greenup	0	0	0	0	0	0	0	0	0
8	Lewis	0	0	0	0	0	0	0	0	0
9	Mason	0	0	0	0	0	0	0	0	0
10	Carter	0	0	0	0	0	0	0	0	0
11	Total Kentucky	0	0	0	0	0	0	0	0	0
12	Counties									
13	State of									
14	West Virginia (%)	17.9	3.1	0.2	0.5	0.2	1	0.7	5.5	--
15	Threshold for EJ									
16	Concerns (%)	37.9	23.1	20.2	20.5	20.2	21	20.7	25.5	--
17	Cabell	1	0	0	0	0	0	0	0	NA
18	Mason	0	0	0	0	0	0	0	0	0
19	Wayne	0	0	0	0	0	0	0	0	0
20	Total West Virginia	1	0	0	0	0	0	0	0	NA
21	Counties									

Table F-3 Number of Census Tracts Exceeding State Environmental Justice Threshold (continued)

County	Below Poverty Level	African American/ Black	Native American	Asian and Pacific Islander	Other Races	Two or More Races	Hispanic or Latino (All Races)	Minorities (Racial Minorities plus White Hispanics)	Total Minority Tracts
Grand Total (3 States)	4	1	0	0	0	0	0	1	NA

Notes:

^a NA = Not available.

Table F-4 Number of Census Tracts Exceeding County Environmental Justice Threshold ^a

County	Below Poverty Level	African American/ Black	Native American	Asian and Pacific Islander	Other Races	Two or More Races	Hispanic or Latino (All Races)	Minorities (Racial Minorities plus White Hispanics)	Total Minority Block Groups
State of Ohio (%)	10.6	11.5	0.2	1.2	0.8	1.5	1.9	16	--
Threshold for EJ Concerns (%)	30.6	31.5	20.2	21.2	20.8	21.5	21.9	36	--
Adams	0	0	0	0	0	0	0	0	0
Athens	2	0	0	0	0	0	0	0	NA
Brown	0	0	0	0	0	0	0	0	0
Clinton	0	0	0	0	0	0	0	0	0
Fairfield	0	0	0	0	0	0	0	0	0
Fayette	0	0	0	0	0	0	0	0	0
Gallia	1	0	0	0	0	0	0	0	NA
Highland	0	0	0	0	0	0	0	0	0
Hocking	0	0	0	0	0	0	0	0	0
Jackson	0	0	0	0	0	0	0	0	0
Lawrence	0	0	0	0	0	0	0	0	0
Madison	0	0	0	0	0	0	0	0	0
Meigs	1	0	0	0	0	0	0	0	NA
Pickaway	0	0	0	0	0	0	0	0	0
Pike	0	0	0	0	0	0	0	0	0
Ross	0	1	0	0	0	0	0	1	NA
Scioto	1	0	0	0	0	0	0	1	NA
Vinton	0	0	0	0	0	0	0	0	0
Total Ohio Counties	5	1	0	0	0	0	0	2	NA

Table F-4 Number of Census Tracts Exceeding County Environmental Justice Threshold (continued)

County	Below Poverty Level	African American/ Black	Native American	Asian and Pacific Islander	Other Races	Two or More Races	Hispanic or Latino (All Races)	Minorities (Racial Minorities plus White Hispanics)	Total Minority Block Groups
State of Kentucky (%)	15.8	7.3	0.2	0.7	0.5	1.2	1.4	10.7	--
Threshold for EJ Concerns (%)	35.8	27.3	20.2	20.7	20.5	21.2	21.4	30.7	--
Boyd	1	0	0	0	0	0	0	0	NA
Carter	0	0	0	0	0	0	0	0	0
Fleming	1	0	0	0	0	0	0	0	NA
Greenup	0	0	0	0	0	0	0	0	0
Lewis	3	0	0	0	0	0	0	0	NA
Mason	1	0	0	0	0	0	0	0	NA
Total Kentucky Counties	6	0	0	0	0	0	0	0	NA
State of West Virginia (%)	17.9	3.1	0.2	0.5	0.2	1	0.7	5.5	--
Threshold for EJ Concerns (%)	37.9	23.1	20.2	20.5	20.2	21	20.7	25.5	--
Cabell	4	0	0	0	0	0	0	0	NA
Mason	1	0	0	0	0	0	0	0	0
Wayne	0	0	0	0	0	0	0	0	0
Total West Virginia Counties	5	0	0	0	0	0	0	0	NA
Grand Total (3 States)	16	1	0	0	0	0	0	2	NA

Notes:

^a NA = Not available.

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APPENDIX G
COST BENEFIT ANALYSIS

APPENDIX G COST BENEFIT ANALYSIS

G.1 Introduction

This appendix describes the methodology used in preparing the incremental cost benefit analysis that is summarized in Section 7.2.

An incremental cost benefit analysis measures the impacts of each alternative relative to a baseline, which is how things would be if the alternative were not imposed (i.e., the no-action alternative). The baseline used in this analysis assumes full licensee compliance with existing NRC requirements, including current regulations. This is consistent with the *Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission* (NRC, 2004), which state that "...in evaluating a new requirement for existing plants, the staff should assume that all existing NRC and Agreement State requirements have been implemented" (NRC, 2004).

The incremental cost benefit analysis described in this appendix compares the proposed action (construction and operation of the proposed ACP at Piketon, Ohio) with the no-action alternative. For the purposes of this analysis, the no-action alternative is defined as continued operation of the Paducah Gaseous Diffusion Plant at Paducah, Kentucky. This appendix presents full details of construction and operating costs and the results of a net present value analysis estimating the economic impact of implementing the proposed action compared to the no-action alternative under different discount rates and production capacity assumptions.

G.2 Methodology and Assumptions

The incremental cost benefit analysis presented in Section 7.2 considers a limited number of costs and benefits in assessing the net present value of implementing the proposed action compared to the no-action alternative. Specifically, the analysis quantitatively assesses direct costs such as construction costs, manufacturing costs, and decontamination and decommissioning costs. The only benefits assessed are those resulting from operating cost savings associated with implementing the proposed action compared to the no-action alternative. Some of the indirect impacts and costs described in Section 7.1.1 are not included as part of this comparative analysis because the effect of these impacts is assumed to be either (1) equal for the proposed action and the no-action alternative as defined above, or (2) too small an impact to materially affect the comparative cost benefit analysis.

The estimates in this analysis reflect costs and benefits to the U.S. economy and not to USEC. All costs and benefits in this analysis are measured in 2005 real dollars (denoted hereafter as 2005\$). Costs and benefits are assumed to accrue at the beginning of the calendar year over which they actually occur.

G.3 Costs of the Proposed Action

Construction Costs: The construction phase of the proposed alternative is estimated to cost \$1,449 million between calendar years 2006 and 2010 (USEC, 2005b). Construction costs are assumed to accrue evenly in each of the calendar years of the construction phase of the proposed action. The construction cost figure USEC provided is not expressed in constant dollars. To be conservative, NRC staff treat these costs as 2005\$. This approach overestimates costs, and is therefore a conservative assumption.

Manufacturing Costs: The manufacturing and assembly phase of the proposed alternative is estimated to cost \$1,423 million between calendar years 2004 and 2013 (USEC, 2005b). Manufacturing costs are assumed to accrue evenly in each of the calendar years of the manufacturing phase of the proposed action. Again, the USEC cost estimates are not expressed in constant dollars. Similar to the assumption made for construction costs, the costs derived from the manufacturing and assembly phase are treated as 2005\$ in the cost benefit analysis. This is a conservative assumption that likely overstates costs.

Decontamination and Decommissioning Costs: Decontamination and decommissioning of the proposed alternative is estimated to cost \$435 million (2004\$) (USEC, 2005b). These costs are adjusted to reflect 2005\$ (NASA, 2005). Decontamination and decommissioning costs are assumed to accrue evenly over six years, commencing 30 years after the first year of operation. The cost benefit analysis does not factor in costs associated with tails disposition. It is assumed that for a given production level, the amount of tails generated by the proposed ACP will be equivalent to the amount of tails that would have been generated using Paducah Gaseous Diffusion Plant (USEC, 2005b). Therefore, no incremental tails disposition costs result from the proposed action relative to the no-action alternative.

G.4 Costs of the No-Action Alternative

No construction or manufacturing costs are associated with the no-action alternative.

The decontamination and decommissioning schedule and costs associated with the Paducah Gaseous Diffusion Plant are considered independent of the proposed alternative and are not included in this analysis.

In addition, this section does not consider the costs and benefits associated with actions pertaining to the Portsmouth Gaseous Diffusion Plant. USEC closed the Portsmouth Gaseous Diffusion Plant in May 2001 to reduce operating costs. The NRC staff do not believe that there has been any significant change in the factors that were considered by USEC in its decision to cease uranium enrichment at Portsmouth. For the purposes of this cost benefit analysis, actions pertaining to the Portsmouth Gaseous Diffusion Plant, such as decontamination and decommissioning, are considered unrelated to the no-action alternative and the proposed action.

G.5 Benefits of the Proposed Action Relative to the No-Action Alternative

Benefits in a given year are computed as the difference between the operating costs per separative work unit of the no-action alternative and the proposed alternative multiplied by the level of production substituted in that year. Two scenarios are assumed:

- (i) the proposed action substitutes 4.6 million separative work units of production at the Paducah Gaseous Diffusion Plant (this figure reflects the anticipated production levels at the Paducah Gaseous Diffusion Plant in 2005); and,
- (ii) the proposed action substitutes 7 million separative work units of production at the Paducah Gaseous Diffusion Plant.

In both scenarios, the proposed ACP is assumed to be producing at the 7 million separative work unit capacity level. The difference is that in the first scenario, the proposed ACP is replacing only 4.6 million separative work units that would otherwise have been produced at the Paducah Gaseous Diffusion Plant. This analysis assumes that the proposed ACP's excess production (2.4 million separative work units) substitutes production from sources that are no more expensive than the proposed ACP. Therefore, incremental benefits from the proposed action do not accrue beyond the 4.6 million separative work units level. In the second scenario, the proposed ACP is substituting 7 million separative work units that would

otherwise have been produced at the Paducah Diffusion Gaseous Plant; the benefits are therefore higher in the second scenario.

In both scenarios, separative work unit production at the proposed ACP is expected to phase-in according to USEC's proposed schedule (USEC, 2005b). Specifically, the proposed ACP is expected to reach an annual capacity of 1 million separative work units per year in 2010, and is projected to have an annual capacity of 3.5 million separative work units per year in 2011 (USEC, 2005b). The proposed ACP is assumed to reach full capacity by 2015. These milestones are factored into the cost benefit analysis.

Operating costs under the no-action alternative are estimated to be approximately four times higher than under the proposed action. These costs are considered to be proprietary and have been withheld here pursuant to 10 CFR 2.390.

G.6 Discount Rates

Three different real discount rates are applied to estimate the net present value of the proposed alternative – zero percent, three percent, and seven percent. These discount rates are consistent with those recommended in NUREG/BR-0184, *Regulatory Analysis Technical Evaluation Handbook* (NRC, 1997). The higher discount rate places a lower value on benefit streams occurring in the future. Net present value estimates are lower under the higher real discount rate because most of the costs associated with the proposed alternative occur up front while benefits are distributed evenly over time.

G.7 Limitations

The cost benefit analysis presented here does not quantitatively estimate potential impacts such as public health effects, occupational health effects, and property value impacts.

Furthermore, certain benefits associated with the proposed alternative, including domestic energy security policy objectives, are not captured in this economic analysis.

As stated in Chapter 7, this analysis does not attempt a dynamic general equilibrium modeling of the economic effects of a cheaper source of enriched uranium for nuclear power plants. No attempt is made to model the effects of reduced enriched uranium prices on the ratio of nuclear and non-nuclear power in the domestic economy, on overall power demand and price, and on the potential economic benefits to consumers and suppliers. Instead, the analysis focuses on estimating the economic savings to society from replacing Paducah Gaseous Diffusion Plant production by a cheaper and less resource-intensive source based on centrifuge technology.

G.8 Results

Table G-1 presents the net present value of implementing the proposed action instead of the no-action alternative for the two scenarios described above at three alternative real discount rates. The figures represent net benefits of the proposed action when compared to the no-action alternative.

**Table G-1 Net Present Value of the Net Benefits of
Proposed Alternative Relative to the No-action Alternative**

Scenario 1: Proposed ACP Substitutes 4.6 Million Separative Work Units of Paducah Gaseous Diffusion Plant Production	
Net Present Value (3 percent) in 2005 in Millions 2005\$	\$3,630
Net Present Value (7 percent) in 2005 in Millions 2005\$	\$966
Net Present Value (0 percent) in 2005 in Millions 2005\$	\$7,992
Scenario 2: Proposed ACP Substitutes 7 Million Separative Work Units of Paducah Gaseous Diffusion Plant Production	
Net Present Value (3 percent) in 2005 in Millions 2005\$	\$6,417
Net Present Value (7 percent) in 2005 in Millions 2005\$	\$2,290
Net Present Value (0 percent) in 2005 in Millions 2005\$	\$13,212

G.9 Conclusions

The analysis indicates that the incremental economic benefits of implementing the proposed action instead of the no-action alternative are substantially positive under both the scenarios and the three discount rates considered, even after accounting for all project-related costs.

G.10 References

- (NASA, 2005) National Aeronautics and Space Administration. "Gross Domestic Product Deflator Inflation Calculator." <<http://www1.jsc.nasa.gov/bu2/inflateGDP.html>> May 25, 2005.
- (USEC, 2005a) United States Enrichment Corporations. "Additional Responses to Request for Additional Information Regarding the Environmental Report (TAC No. L32307) - Proprietary Information." April 21, 2005.
- (USEC, 2005b) United States Enrichment Corporation. "Environmental Report for the American Centrifuge Plant in Piketon, Ohio." Revision 3. NRC Docket No. 70-7004. July 2005.
- (NRC, 1997) U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. "Regulatory Analysis Technical Evaluation Handbook, Final Report," NUREG/BR-0184. January 1997.
- (NRC, 2004) U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research. "Regulatory Analysis Guidelines of the U.S. Nuclear Regulatory Commission," NUREG/BR-0058. September 2004.

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APPENDIX H
ACCIDENT ANALYSIS FOR THE PROPOSED ACP

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The text in this appendix is being withheld pursuant to 10 CFR 2.390.

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APPENDIX I
GLOSSARY

APPENDIX I GLOSSARY

Acid rain: Rain with a pH of less than 5.6.

Agreement State: A state that has signed an agreement with the Nuclear Regulatory Commission under which the state regulates the use of byproduct, source, and small quantities of special nuclear material in that state.

Air pollutant: Any substance in air which could, if in high enough concentration, harm humans, other animals, vegetation, or material. Pollutants may include almost any natural or artificial composition of matter capable of being airborne.

Air quality: A measure of the quantity of pollutants, measured individually, in the air. These levels are often compared to regulatory standards.

ALARA: Acronym for "as low as (is) reasonably achievable." An approach to keep radiation exposures (both to the workforce and the public) and releases of radioactive material to the environment at levels that are as low as social, technical, economic, practical, and public policy considerations allow. ALARA is not a dose limit; it is a practice whose objective is the attainment of dose levels as far below applicable limits as possible.

Alluvium: Loose gravel, sand, silt, or clay deposited by streams or running water.

Alpha particle: A positively charged particle ejected spontaneously from the nuclei of some radioactive elements. It is identical to a helium nucleus that has a mass number of 4 and an electrostatic charge of +2. It has low penetrating power and a short range (a few centimeters in air). The most energetic alpha particle will generally fail to penetrate the dead layers of cells covering the skin and can be easily stopped by a sheet of paper. Alpha particles are hazardous when an alpha-emitting isotope is inside the body.

Ambient Air Quality Standards: Standards established on a State or Federal level, that define the limits for airborne concentrations of designated "criteria" pollutants (nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, and lead), to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Aquifer: A permeable body of rock capable of yielding quantities of groundwater to wells and springs.

Area of potential effects: The geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking (See 36 CFR § 800.16).

Assay: The qualitative or quantitative analysis of a substance often used to determine the proportion of isotopes in radioactive materials.

1 **Atomic Energy Act of 1954 as amended:** A federal law that created the Atomic Energy Commission,
2 which later split into the Nuclear Regulatory Commission and the Energy and Research and Development
3 Administration (ERDA). ERDA became part of the Department of Energy in 1977. This act encouraged
4 the development and use of nuclear energy and research for the general welfare and the security of the
5 United States. This act authorized the Nuclear Regulatory Commission to regulate and license fuel
6 fabrication facilities that seek to receive, possess, use, or transfer special nuclear material.
7

8 **Attainment area:** A region that meets the U.S. EPA National Ambient Air Quality Standards (NAAQS)
9 for a criteria pollutant under the *Clean Air Act*.
10

11 **Background radiation:** Radiation from cosmic sources, naturally occurring radioactive materials,
12 including radon (except as a decay product of source or special nuclear material), and global fallout as it
13 exists in the environment from the testing of nuclear explosive devices. It does not include radiation from
14 source, byproduct, or special nuclear materials regulated by the Nuclear Regulatory Commission. The
15 typically quoted average individual exposure from background radiation is 360 millirems per year.
16

17 **Becquerel (Bq):** A unit used to measure radioactivity. One Becquerel is that quantity of a
18 radioactive material that will have one transformation in one second. There are 3.7×10^{10} Bq in
19 one curie (Ci).
20

21 **Best Management Practices (BMP):** Structural, nonstructural, and managerial techniques recognized to
22 be the most effective and practical means to reduce surface water and groundwater contamination while
23 still allowing the productive use of resources.
24

25 **Beta particle:** A charged particle emitted from a nucleus during radioactive decay, with a mass equal to
26 $1/1837$ that of a proton. A negatively charged beta particle is identical to an electron. A positively
27 charged beta particle is called a positron. Large amounts of beta radiation may cause skin burns, and beta
28 emitters are harmful if they enter the body. Beta particles may be stopped by thin sheets of metal or
29 plastic.
30

31 **Bound:** To estimate or describe a lower or upper limit on a potential environmental or health
32 consequence when uncertainty exists.
33

34 **Buffer area:** A designated area of land that is designed to permanently remain vegetated in an
35 undisturbed and natural condition in order to protect an adjacent aquatic or wetland site from upland
36 impacts and to provide habitat for wildlife.
37

38 **Byproduct material:** The tailings or wastes produced by the extraction or concentration of uranium or
39 thorium from any ore processed primarily for its source material content. See also, Source Material.
40

41 **Carbon monoxide:** An odorless, colorless, poisonous gas produced by incomplete burning of carbon in
42 fuels. Exposure to carbon monoxide reduces the delivery of oxygen to the body's organs and tissues.
43 Elevated levels can cause impairment of visual perception, manual dexterity, learning ability, and
44 performance of complex tasks.
45

46 **Census tract:** An area usually containing between 2,500 and 8,000 persons that is used for
47 organizing and monitoring census data. The geographic dimensions of census tracts vary
48 widely, depending on population density. Census tracts do not cross county borders.

1 **Climatology:** The science devoted to the study of the conditions of the natural environment (rainfall,
2 daylight, temperature, humidity, air movement) prevailing in specific regions of the earth.

3
4 **Cold standby:** Cold standby involves placing those portions of the Gaseous Diffusion Plant needed for 3
5 million separative work units per year production capacity in a non-operational condition. It also includes
6 performing surveillance and maintenance activities necessary to retain the ability to resume operations
7 after a set of restart activities are conducted.

8
9 **Contamination:** Undesired radioactive material that is deposited on the surface of, or inside structures,
10 areas, objects, or people.

11
12 **Cooling water:** Water circulated through a nuclear reactor or processing plant to remove heat.

13
14 **Cost-benefit analysis:** A formal quantitative procedure comparing costs and benefits of a
15 proposed project or act under a set of preestablished rules.

16
17 **Council on Environmental Quality:** The President's Council on Environmental Quality (CEQ)
18 was established by the enactment of *National Environmental Policy Act* (NEPA). The CEQ is
19 responsible for developing regulations to be followed by all federal agencies in developing and
20 implementing their own specific NEPA implementation policies and procedures.

21
22 **Criteria pollutants:** Common air pollutants for which National Ambient Air Quality Standards
23 have been established by the U.S. EPA under Title I of the *Clean Air Act*. Criteria pollutants include
24 sulfur dioxide, nitrogen oxides, carbon monoxide, ozone, particulate matter (PM₁₀ and PM_{2.5}), and lead.
25 Standards for these pollutants were developed on the basis of scientific knowledge about their health
26 effects.

27
28 **Critical habitat:** Specific areas within the geographical range of an endangered species that is
29 formally designated by the U.S. Fish and Wildlife Service under the *Endangered Species Act* as
30 essential for conservation.

31
32 **Cumulative impacts:** Potential impacts when the proposed action is added to other past,
33 present, and reasonable foreseeable future actions. Cumulative impacts can result from
34 individually minor but collectively significant actions taking place over a period of time.

35
36 **Curie (Ci):** The basic unit used to describe the intensity of radioactivity in a sample of material. The
37 curie is equal to 37 billion (3.7×10^{10}) disintegrations per second, which is approximately the activity of 1
38 gram of radium. A curie is also a quantity of any radionuclide that decays at a rate of 37 billion
39 disintegrations per second. It is named for Marie and Pierre Curie, who discovered radium in 1898.

40
41 **Day-Night Average Noise Level (DNL):** DNL is a noise metric combining the levels and durations of
42 noise events and the number of events over an extended time period. It is a cumulative average computed
43 over a set of 24-hour periods to represent total noise exposure. DNL also accounts for more intrusive
44 night time noise, adding a 10 dB penalty for sounds after 10:00 p.m. and before 7:00 a.m.

45
46 **Decibel (dB):** A standard unit for measuring sound-pressure levels based on a reference
47 sound pressure of 0.0002 dyne per square centimeter. This is the smallest sound a human can
48 hear. In general, a sound doubles in loudness with every increase of slightly more than
49 3 decibels.

Decibel, A-weighted (dBA): A number representing the sound level which is frequency weighted according to a prescribed frequency response established by the American National Standards Institute and accounts for the response of the human ear.

Decommissioning: The process of closing down a facility followed by reducing residual radioactivity to a level that permits the release of the property for unrestricted use (see 10 CFR 20.1003).

Decontamination: The reduction or removal of contaminating radioactive material from a structure, area, object, or person. Decontamination may be accomplished by (1) treating the surface to remove or decrease the contamination, (2) letting the material stand so that the radioactivity is decreased as a result of natural radioactive decay, or (3) covering the contamination to shield or attenuate the radiation emitted (see 10 CFR 20.1003 and 20.1402).

Depleted uranium: Uranium having a percentage of uranium-235 smaller than the 0.7 percent found in natural uranium. It is obtained from spent (used) fuel elements or as byproduct tails, or residues, from uranium isotope separation.

Depleted uranium hexafluoride (DUF₆): A compound of uranium and fluorine from which most of the uranium-235 isotope has been removed.

Direct jobs: The number of workers required at a site to implement an alternative.

Dose: The absorbed dose, given in rads (or in SI units, grays), that represents the energy absorbed from the radiation in a gram of any material. Furthermore, the biological dose or dose equivalent, given in rem or sieverts, is a measure of the biological damage to living tissue from radiation exposure.

Dosimetry: The theory and application of the principles and techniques involved in the measurement and recording of radiation doses. Its practical aspect is concerned with the use of various types of radiation instruments with which measurements are made (i.e., film badge, thermoluminescent dosimeter, and Geiger counter).

Effluent: A gas or fluid discharged into the environment, treated or untreated. Most frequently, the term applies to wastes discharged to surface waters.

Emissions: Substances that are discharged into the air.

Endangered species: Any species (plant or animal) that is in danger of extinction throughout all or a significant part of its range. Requirements for declaring a species endangered are found in the *Endangered Species Act*.

Endangered Species Act of 1973: An act requiring federal agencies, with the consultation and assistance of the Secretaries of the Interior and Commerce, to ensure that their actions will not likely jeopardize the continued existence of any endangered or threatened species or adversely affect the habitat of such species.

Erosion: The wearing away of the land surface by wind, water, ice, or other geologic agents. Erosion occurs naturally from weather or runoff but is often intensified by human land use practices.

Exposure: Being exposed to ionizing radiation or to radioactive material.

1 **Exposure pathways:** A route or sequence of processes by which a radioactive or hazardous
2 material may move through the environment to humans or other organisms. Each exposure
3 pathway includes a source or release from a source, an exposure point, and an exposure route.
4

5 **Floodplain:** Low-lying areas adjacent to rivers and streams that are subject to natural inundations
6 typically associated with precipitation.
7

8 **Fuel cycle:** The series of steps involved in supplying fuel for nuclear power reactors. It can include
9 mining, milling, isotopic enrichment, fabrication of fuel elements, use in a reactor, chemical reprocessing
10 to recover the fissionable material remaining in the spent fuel, reenrichment of the fuel material,
11 refabrication into new fuel elements, and waste disposal.
12

13 **Fugitive Dust:** Any solid particulate matter (PM) that becomes airborne, other than that emitted from an
14 exhaust stack, directly or indirectly as a result of the activities of man. Fugitive dust may include
15 emission from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is
16 either removed or redistributed.
17

18 **Geology and Soils:** Those Earth resources that may be described in terms of landforms, geology, and
19 soil conditions.
20

21 **Gray (Gy):** The international system (SI) unit of absorbed dose. One gray is equal to an absorbed dose
22 of 1 Joule/kilogram (one gray equals 100 rads) (see 10 CFR 20.1004).
23

24 **Groundwater:** Water, both fresh and saline, that is stored below the Earth's surface in pores, cracks, and
25 crevices below the water table.
26

27 **Hazardous Air Pollutants (HAPs):** A group of 188 chemicals identified in the *1990*
28 *Clean Air Act Amendments*. Exposure to these pollutants can cause or contribute to cancer, birth defects,
29 genetic damage, and other adverse health effects.
30

31 **Hazardous waste:** According to the *Resource Conservation and Recovery Act*, a waste that,
32 because of its characteristics, may (1) cause or significantly contribute to an increase in
33 mortality or an increase in serious irreversible illness, or (2) pose a substantial hazard to human
34 health or the environment when improperly treated, stored, transported, disposed of, or
35 otherwise managed. Hazardous wastes possess at least one of the following characteristics:
36 ignitability, corrosivity, reactivity, or toxicity. Hazardous waste is nonradioactive.
37

38 **Heels:** In the uranium enrichment process, heels refers to the residual solid uranium hexafluoride left
39 after the feed rate declines to a predetermined level.
40

41 **Highly enriched uranium (HEU):** Uranium enriched in the isotope uranium-235 to 20% or above,
42 which thus becomes suitable for nuclear weapons use.
43

44 **Historic and Cultural Resources:** Cultural resources include any prehistoric or historic district, site,
45 building, structure, or object resulting from, or modified by, human activity. Historic properties are
46 cultural resources listed in, or eligible for listing in, the National Register of Historic Places.
47

48 **Holding ponds:** Engineered depressions in the land that contain storm-water runoff until it
49 can slowly seep back into the ground or evaporate.

Impacts: An assessment of the meaning of changes in all attributes being studied for a given resource. An aggregation of all of the adverse effects, usually measured using a qualitative and nominally subjective technique.

Indirect jobs: Jobs generated or lost in related industries within a regional economic area as a result of a change in direct employment.

Ingestion: To take in by mouth. Material that is ingested enters the digestive system.

Inhalation: To take in by breathing. Material that is inhaled enters the lungs.

Isotope: Any two or more forms of an element having identical or very closely related chemical properties and the same atomic number but different atomic weights or mass numbers.

Land Use: The way land is developed and used in terms of the kinds of anthropogenic activities that occur (e.g., agriculture, residential areas, industrial areas).

Lead: A heavy metal element formerly added to gasoline and paint for improved performance characteristics. Lead can be inhaled and ingested in food, water, soil, or dust. High exposure to lead can cause seizures, mental retardation, and/or behavioral disorders. Low exposure to lead can lead to central nervous system damage.

Low-enriched uranium (LEU): Uranium enriched in the isotope uranium-235, greater than 0.7% but less than 20% of the total mass. Naturally occurring uranium contains about 0.7% uranium-235, almost all the rest is uranium-238.

Low-level mixed waste: Low-level waste that also contains hazardous chemical components regulated under the *Resource Conservation and Recovery Act*.

Low-level radioactive waste: Wastes containing source, special nuclear, or byproduct material are acceptable for disposal in a land disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the *Low-Level Radioactive Waste Policy Act*, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or byproduct material as defined in section 11e.(2) of the *Atomic Energy Act* (uranium or thorium tailings and waste).

Maximally exposed individual (MEI): A hypothetical person who—because of proximity, activities, or living habits—could receive the highest possible dose of radiation or of a hazardous chemical from a given event or process.

Meteorology: The science dealing with the atmosphere and its phenomena, especially as relating to weather.

Microcurie: One millionth of a curie. That amount of radioactive material that disintegrates (decays) at the rate of 37 thousand atoms per second.

Mitigation: A series of actions implemented to ensure that projected impacts will result in no net loss of habitat value or wildlife populations. The purpose of mitigative actions is to avoid, minimize, rectify, or compensate for any adverse environmental impact.

Millirem (mrem): One thousandth of a rem (0.001 rem).

1 **Mixing height:** The height above the earth's surface through which relatively strong vertical mixing of
2 the atmosphere occurs.

3
4 **Modified Mercalli Intensity:** A measurement of earthquake intensity based on the effects to people and
5 structures. Ranges from I (low) to XII (total destruction), as opposed to the Richter scale, which
6 measures the energy of the earthquake. Mercalli scale is often used to classify earthquakes that were not
7 recorded on modern seismographs.

8
9 **National Environmental Policy Act (NEPA) of 1969:** A federal law constituting the basic
10 national charter for protection of the environment. The act calls for the preparation of an
11 environmental impact statement (EIS) for every major federal action that may significantly affect
12 the quality of the human or natural environment. The main purpose is to ensure that
13 environmental information is provided to decision makers so that their actions are based on an
14 understanding of the potential environmental and socioeconomic consequences of a proposed
15 action and the reasonable alternatives.

16
17 **National Historic Preservation Act (NHPA):** A federal law providing that property resources with
18 significant national historic value be placed on the National Register of Historic Places. It does not
19 require permits; rather, it mandates consultation with the proper agencies whenever it is
20 determined that a proposed action might impact a historic property.

21
22 **National Pollutant Discharge Elimination System (NPDES):** A federal permitting system
23 controlling the discharge of effluents to surface waters of the United States and regulated
24 through the *Clean Water Act*, as amended.

25
26 **National Register of Historic Places (NRHP):** A list of districts, sites, buildings, structures,
27 and objects of prehistoric or historic local, state, or national significance. The list is maintained
28 by the Secretary of the Interior.

29
30 **Nitrogen dioxide:** A brownish, highly reactive gas that is present in all urban atmospheres. Nitrogen
31 dioxide can irritate the lungs, cause bronchitis and pneumonia, and lower resistance to respiratory
32 infections. The major mechanism for the formation of nitrogen dioxide in the atmosphere is the oxidation
33 of the primary air pollutant nitric oxide. Nitrogen oxides, together with volatile organic carbons, play a
34 major role in the atmospheric reactions that produce ozone. Nitrogen oxides form when fuel is burned at
35 high temperatures. The two major emissions sources are transportation and stationary fuel combustion
36 sources such as electric utility and industrial boilers.

37
38 **Non-Attainment Areas:** An area that has been designated by the Environmental Protection Agency, or
39 the appropriate state air quality agency, as exceeding one or more national or state Ambient Air Quality
40 Standards.

41
42 **Normal operations:** Conditions during which facilities and processes operate as expected or
43 designed. In general, normal operations include the occurrence of some infrequent events that,
44 although not considered routine, are not classified as accidents.

Ozone: A photochemical (formed in chemical reactions between volatile organic compounds and nitrogen oxides in the presence of sunlight) oxidant and the major component of smog. Exposure to ozone for several hours at low concentrations has been shown to significantly reduce lung function and induce respiratory inflammation in normal, healthy people during exercise. Other symptoms include chest pain, coughing, sneezing, and pulmonary congestion.

Outfall: The place where effluent is discharged into receiving waters.

Particulate matter: Materials such as dust, dirt, soot, smoke, and liquid droplets that are emitted into the air by sources such as factories, power plants, cars, construction activity, fires, and natural windblown dust. Exposure to high concentrations of particulate matter can affect breathing, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems against foreign materials, damage lung tissue, and cause premature death.

Personnel monitoring: The use of portable survey meters to determine the amount of radioactive contamination on individuals; or, the use of dosimetry to determine an individual's occupational radiation dose.

Pigtail operations: Refers to the activities related to the connection and disconnection of the valving and hosing associated with feed and withdrawal operations.

Point source: A source of effluents that is small enough in dimensions that it can be treated as if it were a point. A point source can be either a continuous source or a source that emits effluents only in puffs for a short time.

Pollutant: Any material entering the environment that has undesired effects.

Pollution: The addition of an undesirable agent to the environment in excess of the rate at which natural processes can degrade, assimilate, or disperse it.

Pollution prevention: The use of any process, practice, or product that reduces or eliminates the generation and release of pollutants, hazardous substances, contaminants, and wastes, including those that protect natural resources through conservation or more efficient utilization.

Prime farmland: Land with the best combination of physical and chemical characteristics for economically producing high yields of food, feed, forage, fiber, and oilseed crops with minimum inputs of fuel, fertilizer, pesticides, and labor. Prime farmland includes cropland, pastureland, rangeland, and forestland.

Rad: The special unit for radiation absorbed dose, which is the amount of energy from any type of ionizing radiation (e.g., alpha, beta, gamma, neutrons, etc.) deposited in any medium (e.g., water, tissue, air). A dose of one rad means the absorption of 100 ergs (a small but measurable amount of energy) per gram of absorbing tissue (100 rad = 1 gray).

Radiation (ionizing radiation): Alpha particles, beta particles, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other particles capable of producing ions. Radiation, as used in 10 CFR Part 20, does not include non-ionizing radiation, such as radio- or microwaves, or visible, infrared, or ultraviolet light. (see also 10 CFR 20.1003)

Radiation standards: Exposure standards, permissible concentrations, rules for safe handling, regulations for transportation, regulations for industrial control of radiation, and control of radioactive material by legislative means.

Radioactivity: The spontaneous decay or disintegration of unstable atomic nuclei, accompanied by the emission of radiation. Eventually the unstable nuclei reach a stable state.

Radionuclide: An atom that exhibits radioactive properties. Radionuclides can be man-made or naturally occurring, can have a long life, and can have potentially mutagenic or carcinogenic effects on the human body.

Region of influence (ROI): The physical area that bounds the environmental, sociological, economic, or cultural features of interest for the purpose of analysis. A site-specific geographic area that includes the counties where approximately 90% of the site's current employees reside.

Rem: The acronym for roentgen equivalent man is a standard unit that measures the effects of ionizing radiation on humans. The dose equivalent in rems is equal to the absorbed dose in rads multiplied by the quality factor of the type of radiation (see 10 CFR 20.1004).

Remediation: Action taken to permanently remedy a release, or threatened release, of a hazardous or radioactive substance to the environment, instead of or in addition to removal.

Resource Conservation and Recovery Act (RCRA): A federal law that provides for a "cradle-to-grave" regulatory program for hazardous waste, including a system for managing hazardous waste from its generation to its ultimate disposal.

Restricted area: Any area to which access is controlled for the protection of individuals from exposure to radiation and radioactive materials.

Roentgen: A unit of exposure to ionizing radiation. It is the amount of gamma or x-rays required to produce ions resulting in a charge of 0.000258 coulombs/kilogram of air under standard conditions. Named after Wilhelm Roentgen, the German scientist who discovered x-rays in 1895.

Runoff: The portion of rainfall that is not absorbed by soil, evaporated, or transpired by plants, but finds its way into streams directly or as overland surface flows.

Sanitary/industrial waste: Nonhazardous, nonradioactive liquid and solid waste generated by normal housekeeping activities.

Sediment: Eroded soil particles that are deposited downhill or downstream by surface runoff.

Shielding: Any material or obstruction that absorbs radiation and thus tends to protect personnel or materials from the effects of ionizing radiation.

Sievert (Sv): A unit of radiation dose used to express a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation by taking into account the kind of radiation received, the total amount absorbed by the body, and the tissues involved. Not all radiation has the same biological effect, even for the same amount of absorbed dose. One sievert is equivalent to 100 rem.

1 **Site characterization:** An onsite investigation at a known or suspected contaminated waste or release
2 site to determine the extent and type(s) of contamination.

3
4 **Source material:** Uranium or thorium ores containing 0.05 percent Uranium or Thorium regulated under
5 the *Atomic Energy Act*. In general, this includes all materials containing radioactive isotopes in
6 concentrations greater than natural and the byproduct (tailings) from the formation of these concentrated
7 materials

8
9 **Special nuclear material:** Plutonium, uranium-233, or uranium enriched in the isotopes uranium-233 or
10 uranium-235.

11
12 **State Historic Preservation Officer (SHPO):** The state officer charged with the identification
13 and protection of prehistoric and historic resources in accordance with the *National Historic*
14 *Preservation Act*.

15
16 **Subsidence:** The process of sinking or settling of a land surface due to natural or artificial
17 causes.

18
19 **Sulfur dioxide:** A gas emitted largely from stationary sources such as coal and oil combustion, steel and
20 paper mills, and refineries. It is a primary contributor to acid rain and contributes to visibility
21 impairments in large parts of the country. Exposure to sulfur dioxide can affect breathing and may
22 aggravate existing respiratory and cardiovascular disease.

23
24 **Surface water:** Water located on the surface of the Earth in water bodies such as lakes, rivers, streams,
25 ponds, wetlands, and the ocean.

26
27 **Tails:** In the uranium enrichment process, tails refers to gas with a reduced concentration of the
28 uranium-235 isotope.

29
30 **Threatened Species:** Plant and wildlife species that are likely to become endangered in the foreseeable
31 future.

32
33 **Toxic Substances Control Act (TSCA):** A federal law authorizing the U.S. Environmental
34 Protection Agency to secure information on all new and existing chemical substances and to
35 control any of these substances determined to cause unreasonable risk to public health or the
36 environment. This law requires that the health and environmental effects of all new chemicals
37 be reviewed by the EPA before such chemicals are manufactured for commercial purposes.

38
39 **Uranium:** A radioactive element with the atomic number 92 and, as found in natural ores, an atomic
40 weight of approximately 238. The two principal natural isotopes are uranium-235 (0.7 percent of natural
41 uranium), which is fissile, and uranium-238 (99.3 percent of natural uranium), which is fissionable by fast
42 neutrons and is fertile. Natural uranium also includes a minute amount of uranium-234.

43
44 **Visual Resource Management (VRM):** A process devised by the Bureau of Land
45 Management to assess the aesthetic quality of a landscape and to design proposed activities in
46 a way that would minimize their visual impact on that landscape. The process consists of a
47 rating of site visual quality followed by a measurement of the degree of contrast between the
48 proposed development activities and the existing landscape.

1 **Visual and Scenic Resources:** Natural or developed landscapes that provide information for an
2 individual to develop their perceptions of the area. The size, type, gradient, scale, and continuity of
3 landforms, structures, land use patterns, and vegetation are all contributing factors to an area's visual
4 character and how it is perceived.
5

6 **Volatile Organic Compounds (VOCs):** Organic compounds that easily volatilize or evaporate and can
7 break down through photodestructive mechanisms. VOCs contribute to air pollution, especially the
8 generation of tropospheric ozone (O₃).
9

10 **Waste management:** The planning, coordination, and direction of functions related to
11 generation, handling, treatment, storage, transportation, and disposal of waste. It also includes
12 associated pollution prevention and surveillance and maintenance activities.
13

14 **Waste minimization:** An action that economically avoids or reduces the generation of waste
15 by source reduction and recycling; or reduces the toxicity of hazardous waste, improving energy
16 usage.
17

18 **Water resources:** This term includes both freshwater and marine systems, wetlands, floodplains, and
19 ground water.
20

21 **Well field:** Area containing one or more wells that produce usable amounts of water.
22

23 **Wetlands:** Land or areas exhibiting the following characteristics: hydric soil conditions; saturated or
24 inundated soil during some part of the year and plant species tolerant of such conditions; also, areas that
25 are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support,
26 under normal circumstances, a prevalence of vegetation typically adapted for life in saturated soil
27 conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

